JANUARY 11, 1954

Electrical World

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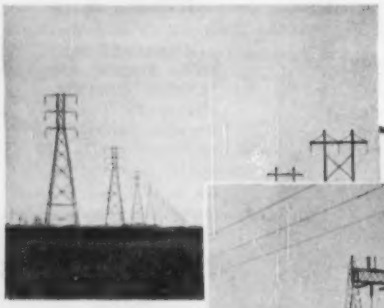
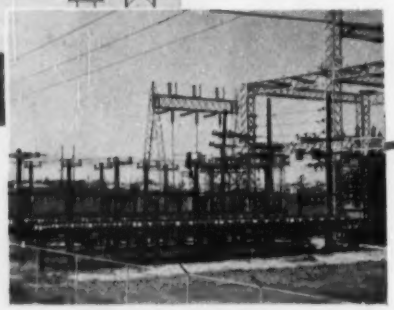
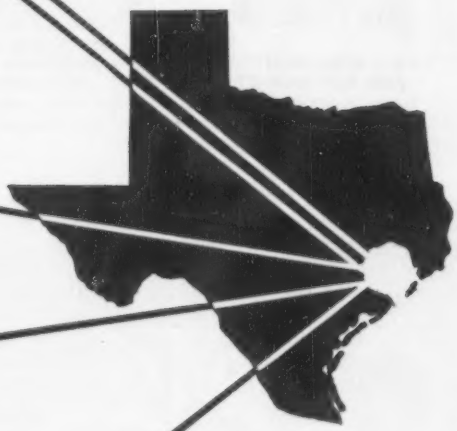
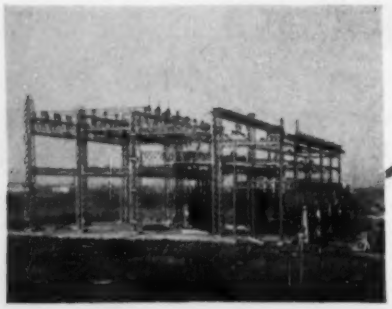
Houston Goes All Out To Make System Carry Triple 1946 Load...









...Expect Load to Double Again by 1963

See Page 92

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Indoor gangable.

SOCKET METER TROUGHS WITH AND WITHOUT HUBS

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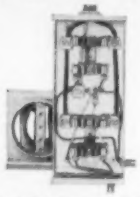
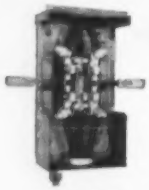


Raintight type — vertical.

SOCKET METER MOUNTINGS — RAINTIGHT TYPE

Medium duty, single phase and polyphase.



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Up to 200 Amperes.

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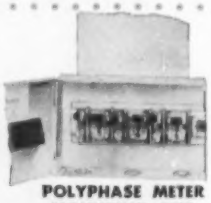
For "A" Base Meter Boxes.
Indoor and Outdoor.

"A" BASE METER CONNECTION BOX
Raintight type.
Two sizes up to 2/0 wire.

"A" BASE METER MOUNTING AND TEST CABINET
Indoor. Single phase and polyphase up to 200 Amps.



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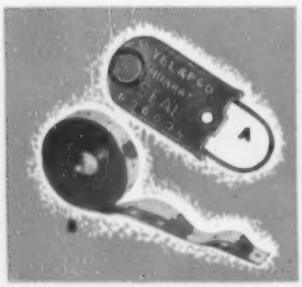

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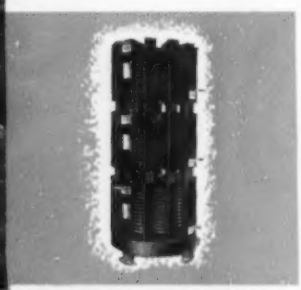

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Meet This Week's Writers

DEL'HOMME RIEVES

How Houston Lighting & Power Co has planned to meet its gigantic post-war load growth is discussed on page 92 by L. K. Del'Homme, superintendent of engineering, and S. L. Rieves, general engineer. Del'Homme joined the utility in 1925 and has held his present post since 1938. A native of Houston, he holds a B.S. degree in electrical engineering from the University of Texas. He has a son and daughter, both married, and three grandchildren. His co-author has been with Houston Lighting since 1951, before which he was associated with the Fort Worth regional office of the Federal Power Commission and Freese & Nichols, consulting engineers. Also holder of a B.S. electrical engineering degree from U. of T., he has a boy, 15. He devotes his leisure time to scouting activities.

Archer Knowlton, our Senior Associate Editor, deserves credit for some excellent downfield blocking leading to preparation of the article on "Abnormal Voltages in 4-Wire Distribution Feeders" (page 84). As long ago as Nov. 6, 1950, he was saying in his "Technical Notes" column:

"Delta-connected capacitors served from a 4-wire wye system are risky because a phase fault may result in resonant overvoltages and burn out of lamps and motors."

This assertion, coupled with an amplifying editorial that he wrote two months later, inspired General Electric Co engineers to look into the proposition. Result, three years after the seed was planted, was preparation by Messrs. P. E. Hendrickson, I. B. Johnson, and N. R. Schultz of a technical paper for AIEE and the abstract of that paper appearing in this issue.

Electrical World

Published for 79 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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easy to splice

Splicing Okolite-Okoprene rubber-insulated shielded cables is a simple and easy operation. No lead wipe is required, nor is a filling compound necessary. The fewer man hours required mean a lower cost splice and more rapid installation. Important, too, moisture present in underground installations will not affect the tapes used in this permanent splice. Ease of splicing is another reason why the switch today is to Okolite rubber-insulated cables for high voltage use.

• Splicing Okolite-Okoprene at a large southern chemical plant.

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There is a distinct trend among industrials and public utilities toward Okolite rubber-insulated cables for high voltage use.

ADVANTAGES

1. Lighter and easier handling.
2. Eliminates sheath corrosion and fatigue.
3. Simplifies splicing and terminating.
4. Moisture does not affect the insulation.
5. No oil migration at high temperatures or elevations.
6. Flexibility simplifies installation.

APPLICATIONS

1. Transmission and distribution circuits.
2. Generator and transformer leads.
3. Vertical risers and shaft cables.
4. Submarine power cables.
5. Portable substation cables and test leads.
6. X-ray cables.

Send for this 128-page manual on rubber-insulated high voltage cable. It provides current carrying capacity tables, dimensional data, engineering information and installation procedures, complete instructions and detailed drawings for splices and terminations. Write for Bulletin EW 1075 on your letterhead to The Okonite Company, Passaic, New Jersey.

OKONITE SINCE 1878 *insulated cables*

. 1882

Type No. 301
Triangular Structure*

LIST OF MATERIALS

Quantity	Description
1	Crossarm
1 pr.	Wood crossarm brace
3	Pin-type insulator
1	Ridge iron, single
1	Crossarm pin, short shank
2	Crossarm pin, long shank w/saddle
2	Flanged washer 3" sq. x 3/16", ¾" tap
4	Machine bolt ⅝"
2	Curved washer 2½" sq. x 3/16", 11/16" hole
1	Spring washer
3	MF locknut ⅝"

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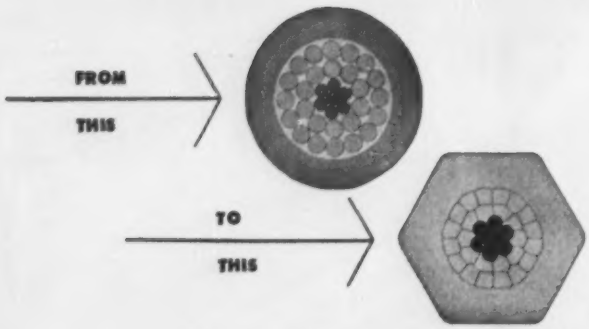

. . . IN SECONDS

Compression Dead End

THE STRONGEST CONNECTION FOR ACSR

T & B connector assemblies for dead-ending ACSR develop tensile strengths greater than that of the cable itself. Coated serrations inside the inner clevis barrel provide a sure, certain grip that matches the full strength of the steel core. The aluminum outer compression sleeve assures high conductivity of the joint. Both sleeves are easily installed with light-weight, portable T & B METHOD hydraulic tools which compress joints hexagonally and force the fitting and cable into one homogeneous mass . . . all in a few seconds.

Electrically, T & B Dead Ends offer higher conductance than equal lengths of cable — the one-piece aluminum tube provides uninterrupted current path from cable to jumper loop. During compression, the special serrated T & B compression sleeve penetrates the aluminum oxide film on the *outside* cable strands providing clean overall metal-to-metal contact, as well as minimum current loss. Oxide film on the *inner* strands is also effectively abraded, thereby maintaining a dense, tight joint.

Though the use of an oxide-inhibiting agent is recommended for T & B METHOD aluminum connections, no joint compounds are needed to obtain maximum electrical efficiency.

Investigate the complete line of T & B fittings for ACSR, aluminum cable and copper cable installation — they offer you important savings in time and installation costs. Write for your free copy of T & B Bulletin U-2.

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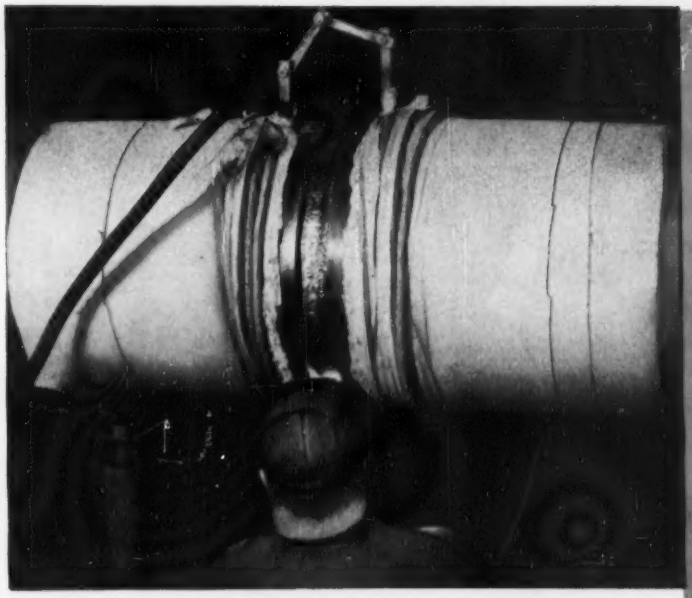
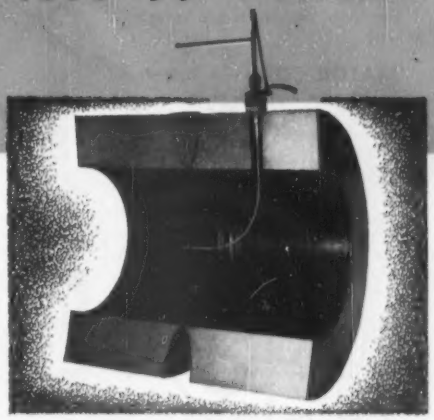


SHOP WELDING 4" WALL PIPE

for steam at 2050 PSI and 1050° F!



A test piece of 4" wall pipe cut apart to show the quality of the weld. Also illustrated is the method used to introduce a radium capsule into the center of a completed assembly for radiographic examination of the weld.

You can be confident of the piping fabricated in Grinnell shops, because Grinnell Research predetermines materials and methods, then checks results to insure that specifications are met exactly.

An example of the thoroughness of Grinnell Research is the preparatory work which was done to insure the performance of the piping shown above. This sub-assembly is being fabricated from 4" wall pipe forged from 2¼% chrome, 1% moly steel. To withstand the high pressure and temperature of this installation, Grinnell Research specified the fabricating and welding procedures to be used. This included the time and temperature cycles for preheating and stress relieving, and the correct type of electrodes.

Preliminary test welds on sample pipe were made. These were then cut apart and analyzed to check microstructure and strength of the weld, which had to have the same properties as the pipe itself.

Taking photomicrograph of specimen of a test weld.

During fabrication, the first inch of each weld was ground smooth and given a complete radiographic examination for possible flaws. Finally the completed weld was checked by radiographic examination.

It's intricate business . . . developing correct fabrication methods for new materials and services. It's one of the jobs for which Grinnell fabrication specialists are well qualified, because Grinnell has the equipment and modern methods, the interpretive engineering, the metallurgical research facilities and the skilled personnel to handle any prefabrication requirement.

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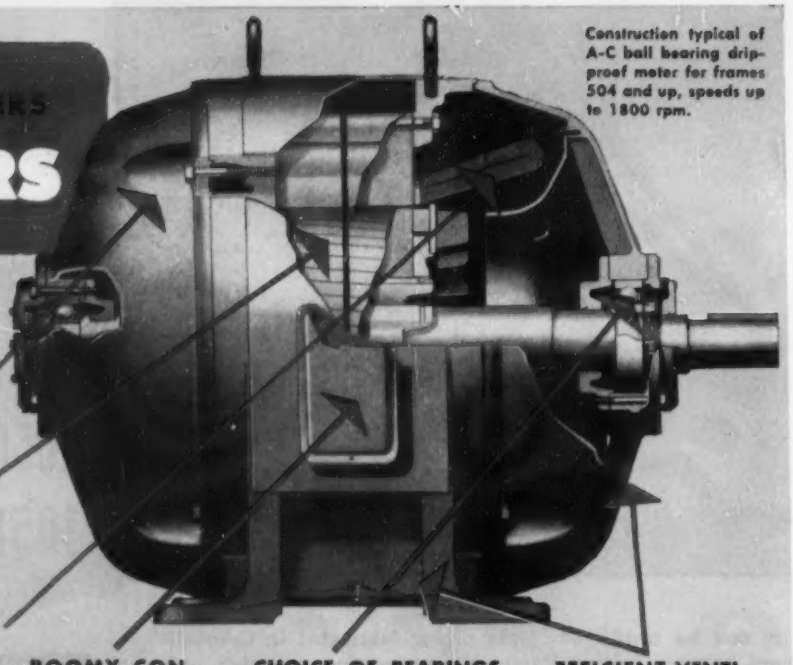

Construction typical of A-C ball bearing drip-proof motor for frames 504 and up, speeds up to 1800 rpm.

All These Features of Good Motor Design

CAST IRON END SHIELDS— assure distortion-free bearing support for maximum bearing life, correct rotor alignment, uniform air gap.

BRAZED CAGE WINDING — copper or copper alloy cage bars are brazed to end ring to produce a practically indestructible rotor winding.

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ROOMY CONDUIT BOX — has ample room for easy connection of leads, may be rotated in 90 degree steps.

CHOICE OF BEARINGS — motors may be obtained with either ball or ring-oiled sleeve bearings. Ball bearings are housing mounted with provisions for in-service lubrication.

EFFICIENT VENTILATION — large intake and discharge openings with ample-sized fan assure a sweeping flow of cooling air. Careful baffling of air flow and plenty of space back of stator core assure adequate, even cooling.

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1 Nation-Wide Certified Service — Allis-Chalmers Certified Service Shops located throughout the country provide factory-approved parts and service on your Allis-Chalmers motors. A-C Certified Service Shops are independently owned shops that meet the strict A-C standards for modern equipment, experience, and business integrity. They provide you with prompt, economical repair and maintenance.

2 Complete Drive From One Source Allis-Chalmers can supply your complete drive — control — motor — *Texrope* V-belt drive — from one convenient source.

3 Competent Engineering Help Your local Allis-Chalmers District Office representative or Authorized Distributor will be glad to help you select exactly the right motor for your needs. For additional information, write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 51B6052.

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⅜ Cu. Yd. — 5-Ton

T-35 BANTAM CRANE CARRIER MOUNT
⅜ Cu. Yd. — 6-Ton

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Rugged, simple design; a machine that averages less than $100 a year for parts and maintenance (truck-mounted); a low cost machine with these features normally found ONLY on larger, more expensive rigs: 360° full circle swing for placing equipment and material in tight quarters; standard equipment power boom hoist; 10 to 12,000 lb. lifting capacities; easy-to-maintain mechanical controls, quick to reach; complete versatility with 9 fast-change attachments which enable you to handle dozens of chores!

Now is the time to see these rigs ON YOUR JOBS! A free demonstration is yours for the asking — without obligation. SEE FOR YOURSELF the BIG advantages of the Bantam Method for handling power pole erection, transformer placement and replacement, plant maintenance chores, underground installations, handling coal and other bulk materials from stockpile and loading out line maintenance trucks!

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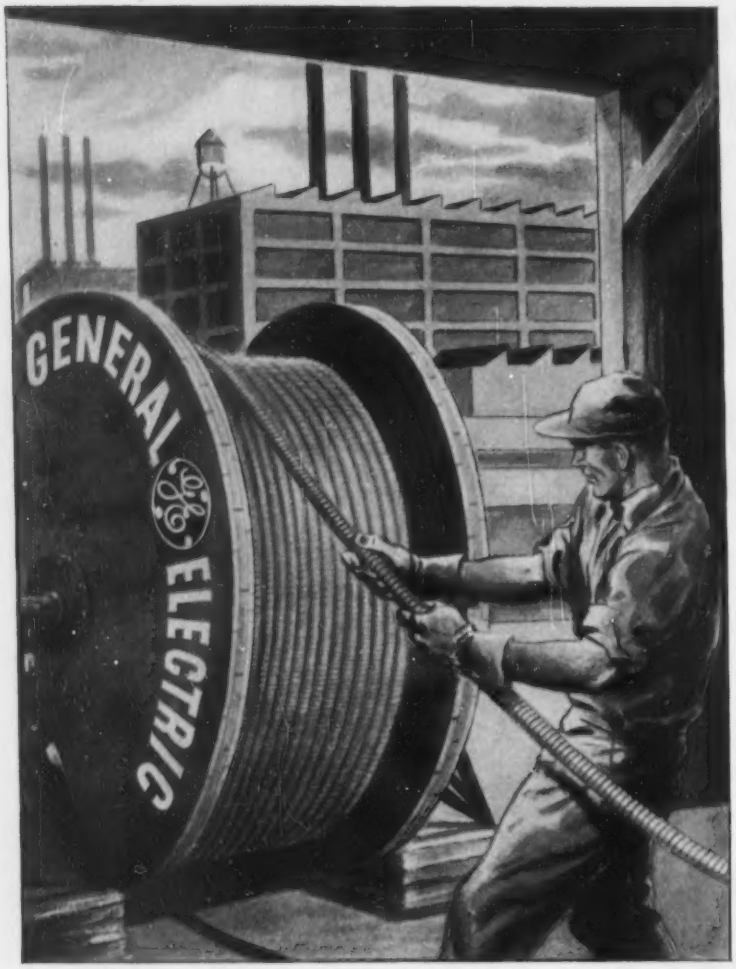


G-E V-C INTERLOCKED ARMOR CABLE SYSTEM cuts both time and cost

Installation Time Reduced

If you're building or modernizing a plant, and production can't wait, use a General Electric V-c interlocked armor cable system for primary and secondary power distribution. It can be installed fast, indoors or outdoors, around corners, over beams, in long runs down the production lines. The cable is installed on low-cost aluminum racks hung from the ceiling, and spliced with simple mechanical joints. Engineering, as well as installation time, is cut; production can start much sooner than would otherwise be possible.

Wiring Costs Reduced

The cost table at the right will show you another good reason for using G-E armored cable. Installed costs of secondary feeders are 24% lower than those of the next most economical system. Add to this the future cost savings due to the adaptability of an armored cable system. Each circuit is a separate cable that can be moved or spliced easily when load requirements change.

For further information on this quickly and economically installed cable system, consult your G-E cable specialist, or write Section W114-127, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

COMPARISON OF MATERIAL COSTS
for plant distribution systems (Rated capacity 2000 amperes at 480 volts)

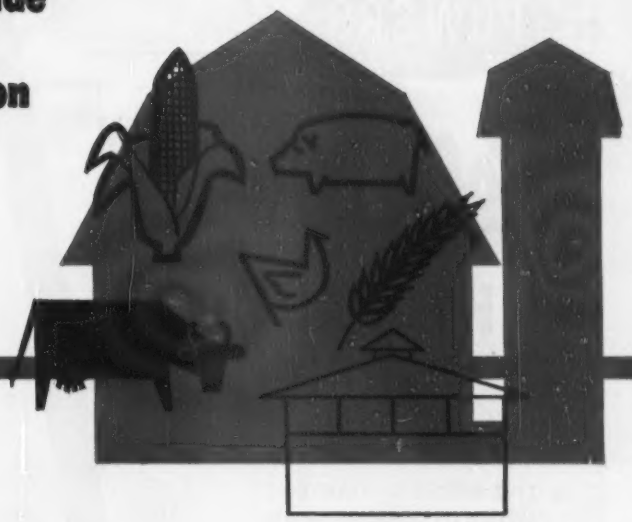
Carrier	Estimated cost per 100 feet
Varnished cambric interlocked armor cable system including racks*	$3000
Varnished cambric and braid in steel conduit	$3966
Type RH rubber insulation in steel conduit	$4660
Aerated bus-way	$4976

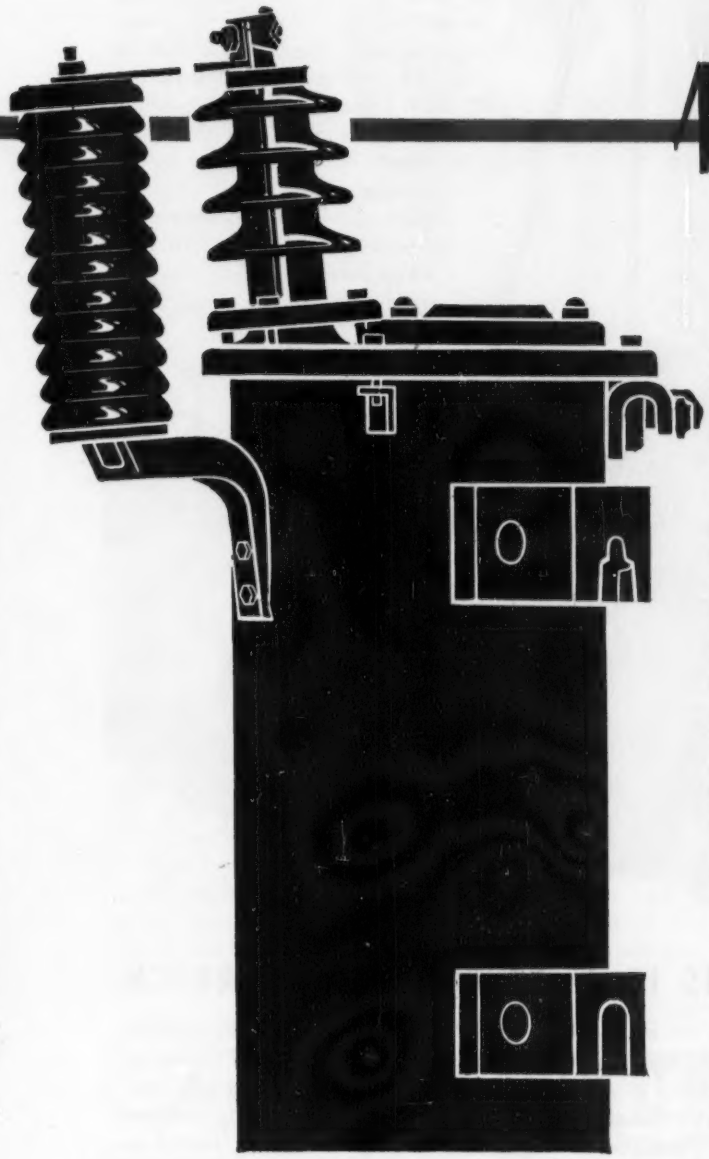
*Figures based on steel racks. Aluminum racks are normally used because they are lighter and easier to handle.

You can put your confidence in—

GENERAL ELECTRIC

Kuhlman Rural Transformers provide efficient, low-cost rural distribution





Made in Standard and CSP models, Kuhlman Rural Distribution Transformers are specifically engineered to give efficient, economical performance and maximum continuity of service for rural systems. These units incorporate the Bent Iron Core, a development of Kuhlman engineers that has never been equaled in the transformer industry. Made of cold rolled oriented silicon steel, the Kuhlman Bent Iron Core permits the flux path to follow the grain of the steel, insuring low loss, low exciting current and substantial weight savings. Exciting current is further reduced by the lapped joint construction of the core. Insulation of Kuhlman Rural Distribution Transformers in windings, leads, terminal boards and bushings is coordinated with the basic impulse level. Wide oil ducts allow ample oil circulation through the windings, insuring substantially uniform coil temperature and increasing short time overload capacity. Strong, sturdy construction, Corprene sealing gaskets and three coats of baked-on enamel finish protect Kuhlman Rural Distribution Transformers in severe weather, insuring utmost operating efficiency with minimum attention. The built-in features of Kuhlman CSP Transformers give protection against interruption of service due to lightning and overloads.

Utility engineers can get complete information about Kuhlman Rural Distribution Transformers by writing today for Bulletin CS-401. Kuhlman also manufactures Power, Dry Type, Subway, Saf-T-Kuhl, CSP and Series Street Lighting Transformers to the same high standards. We will be glad to send you our bulletins on these units also.

143-T

KUHLMAN

KUHLMAN ELECTRIC COMPANY, BAY CITY, MICHIGAN • Southern Division, CRYSTAL SPRINGS, MISSISSIPPI

EXPORT REPRESENTATIVE: INTERNATIONAL STANDARD ELECTRIC CORP., 15TH FLOOR, 50 CHURCH STREET, N. Y. 7, N. Y. CABLE ADDRESS: MICROPHONE, N. Y.

SIXTY YEARS OF PROGRESS IN THE ELECTRICAL INDUSTRY

POWERS *American*

SERIES HD-1

"Pole-Master"

fully-powered HYDRAULIC DERRICK

- LIVE BOOM — CAN BE OPERATED UNDER LOAD
- INFINITE OPERATING POSITIONS
- REQUIRES ONLY SINGLE-DRUM WINCH
- LIFTS LOADS TO BODY PLATFORM
- NO CENTER LEG TO OBSTRUCT BODY CARGO AREA

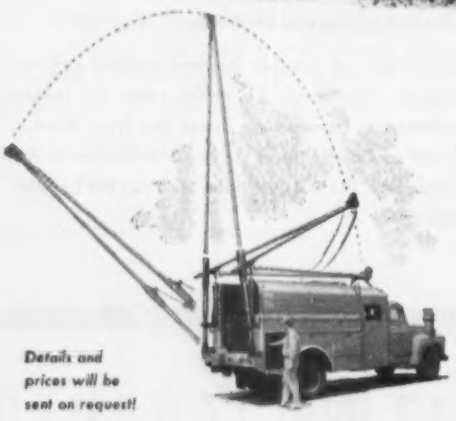
"The Accepted Standard with Utilities Everywhere"

Operation of the Series HD-1 derrick is *completely hydraulic.* It is raised to working position, elevated or lowered to desired height, and returned to carrying position . . . hydraulically.

There is no mechanism to endanger workmen — no center leg to obstruct the body cargo area — no manual operation, other than insertion and removal of locking pins, and shifting of hydraulic control levers.

This is a *heavy-duty* derrick which will handle poles up to 55 ft. in length — under the most severe operating conditions.

Capacity, with head sheave 5′ to rear of body, is 6000 lbs. When extended to 14′, capacity is 2500 lbs.



Details and prices will be sent on request!

THIS IS A "Live Boom" DERRICK

There are no pre-determined "stops" to limit operation of the derrick. It can be spotted in an unlimited number of positions, and moved at any time — even while supporting a full load.

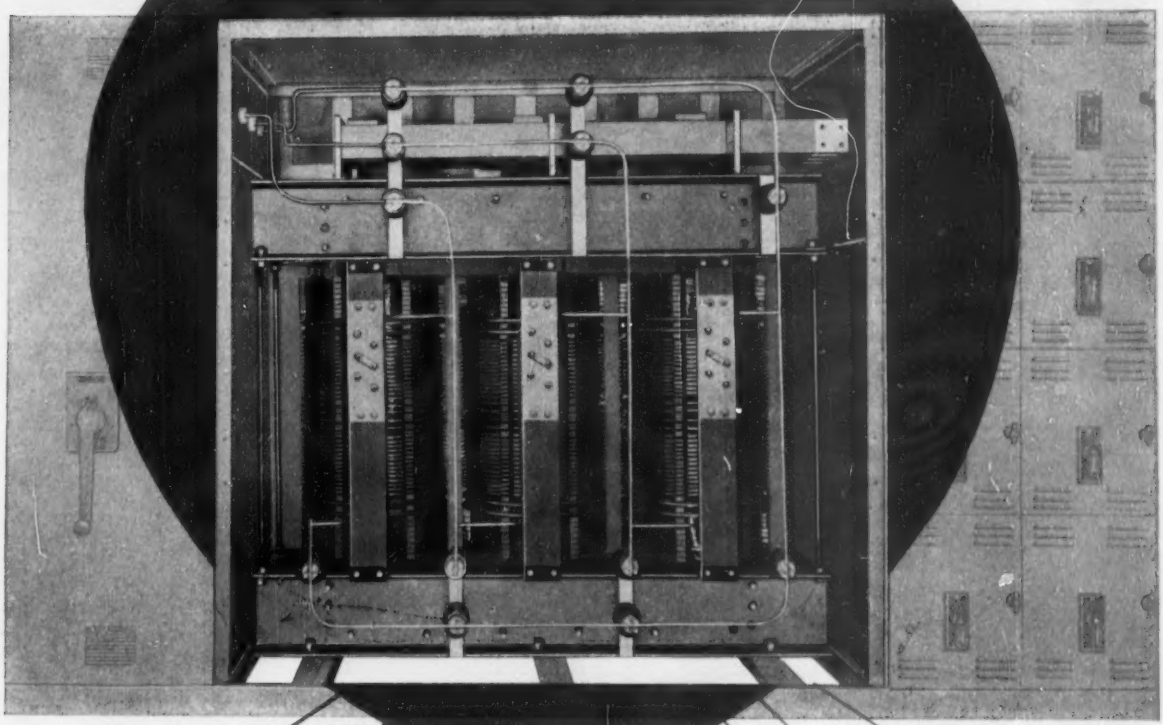
Twin hydraulic rams raise the derrick from carrying position to working position in less than a minute. When derrick is spotted, a poppet-type control valve seals oil in cylinders to prevent "kick back" or "creeping".

POWERS-AMERICAN DIVISION

McCABE-POWERS AUTO BODY COMPANY

5900 NO. BROADWAY • ST. LOUIS 15, MO.
428 LATHAM SQ. BLDG. • OAKLAND 12, CALIF.

The transformer is the heart of a substation



1000 Kva 13,200 volt Sorgel transformer in a substation—(compartment panel removed)

A substation is no better than its transformer; therefore, it is important that the transformer is of the best quality—a Sorgel air-cooled dry-type transformer.

Dry-type transformers are the most practical type for indoor installations. They require little or no maintenance; no liquid to check or replenish; no fire hazard; small and compact; economical; easy and convenient to install; no vault required; can be placed close to load center, resulting in better voltage regulation, more efficient distribution and lower wiring cost. Easily moved when required for expansion or alterations.

Sorgel air-cooled dry-type transformers are top quality, time tested, and are thus recognized and accepted by discriminating engineers and users. Their rugged construction assures continuous, reliable service. Their design is liberal. Efficiency is high. Quiet operation.

The Sorgel Electric Co. has had over 35 years of experience in the development, manufacturing and application of dry-type transformers.

Sorgel air-cooled transformers are procurable with any make of switch gear, and from any substation manufacturer.

Complete Line
for every purpose
¼ Kva to 3000 Kva
All voltages
120 to 15,000 volts

SORGEL
AIR-COOLED
Dry-Type
TRANSFORMERS

Also
Reactors D.C. Saturable
and
Special Transformers

Sales Engineers in Principal Cities

SORGEL ELECTRIC CO., 834 West National Ave., Milwaukee 4, Wis.

Pioneers in the development and manufacturing of Air-Cooled Dry-Type Transformers—Over 35 years

in our plazas,
parking areas, shopping centers and drive-ins
NEWARK AIRPORT
P & K Double and Single Tapered Elliptical Arm type standards installed here have 25 foot mounting heights, TB-2 Transformer Bases and 12 foot arms. Four 20 foot floodlight poles with twin projector assemblies are also installed. They are in perfect harmony with Newark Airport's recently modernized appearance and efficiency.

the P&K story

in our communities . . .
LEVITTOWN, PENNSYLVANIA
Scheduled for completion by the end of 1954, Levittown, Pa. will be the state's tenth largest city! Its streets will feature modern, efficient lighting provided by more than 4,000 P & K All-Aluminum Standards and Brackets: 20 foot pendant type with P & K Tapered Elliptical Lighting Arms.

P & K ALL-ALUMINUM STANDARDS AND BRACKETS ARE PRODUCED IN DESIGN AND TYPE TO MEET *EVERY* ROAD, HIGHWAY, AREA OR FLOOD LIGHTING REQUIREMENT. They are always the wisest investment for both efficiency and economy:

- Much lighter weight for easy handling and low cost installation
- Negligible rate of corrosion for longest service life
- No painting means initial and year-after-year saving
- Easily salvaged and re-used in event of knockdown

WRITE FOR LATEST P & K CATALOG . . . and use the P & K planning and advisory services without obligation.

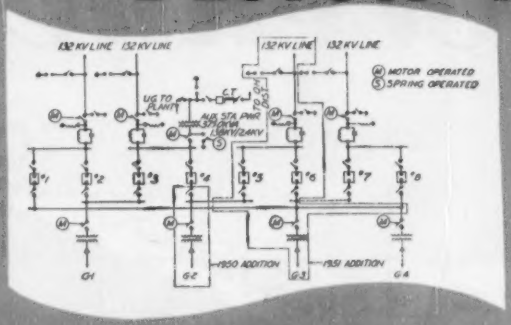
on our highways . . .
THE NEW JERSEY TURNPIKE
Looking toward Laurel Hill and the Lewandowski Bridge crossing the Hackensack River. The P & K All-Aluminum Standards on Transformer bases have 30 foot mounting heights with 15 foot All-Aluminum Tapered Elliptical Arms. They are installed at all interchanges, bridges and service areas along the entire highway.

Pfaff & Kendall
84 Foundry Street
Newark 5, New Jersey

here's the easy way to solve

your substation

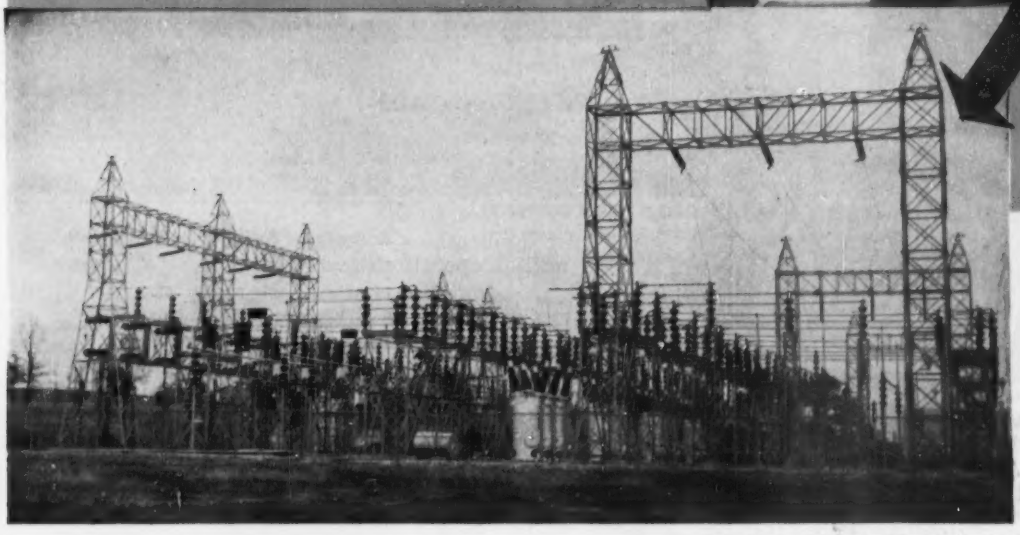
DESIGN PROBLEMS



STEP 1—Make one line diagram with specifications. No station layout required.

STEP 2—Submit to Southern States.

STEP 3—The station shipped to job site ready for erection.

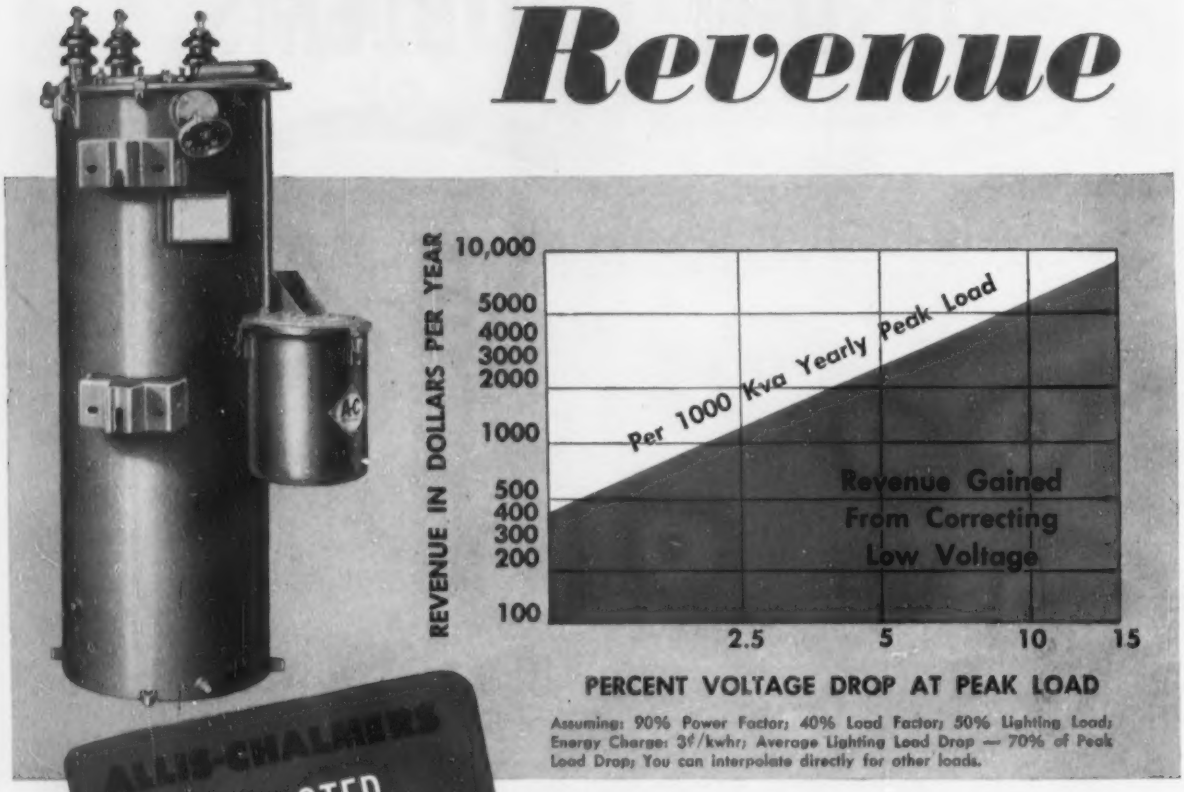


Through the years Southern States' experienced team, skilled in engineering, procurement and manufacturing, has provided **single responsibility service** in meeting your substation requirements. Whether it be detailed engineering or materials ordering for job site delivery, we relieve you and your staff of the many details necessary to coordinate procurement with construction schedules.

Southern States Equipment Corp.

HAMPTON GEORGIA

HOW SMALL INVESTMENT ...Increases Revenue



ALLIS-CHALMERS
5/8% STEP VOLTAGE REGULATORS

The chart above shows it pays in increased revenue to get accurate voltage by using Allis-Chalmers distribution regulators. Initial cost is low. And operating costs are low too because you get reliable regulation with an absolute minimum of maintenance.

Get Years of Satisfactory Operation

...the *Quick-Break* mechanism has been field tested for twenty years in thousands of applications — it can withstand five million operations.

. . . long-life contacts are made of arc-resisting material in generous dimensions . . . will last for 40 years normal operation.

. . . unit construction makes top-quality workmanship possible because all connections can be made and inspected before tanking.

. . . installation and maintenance are easy — careful engineering eliminates necessity for highly trained operators.

Get More Facts

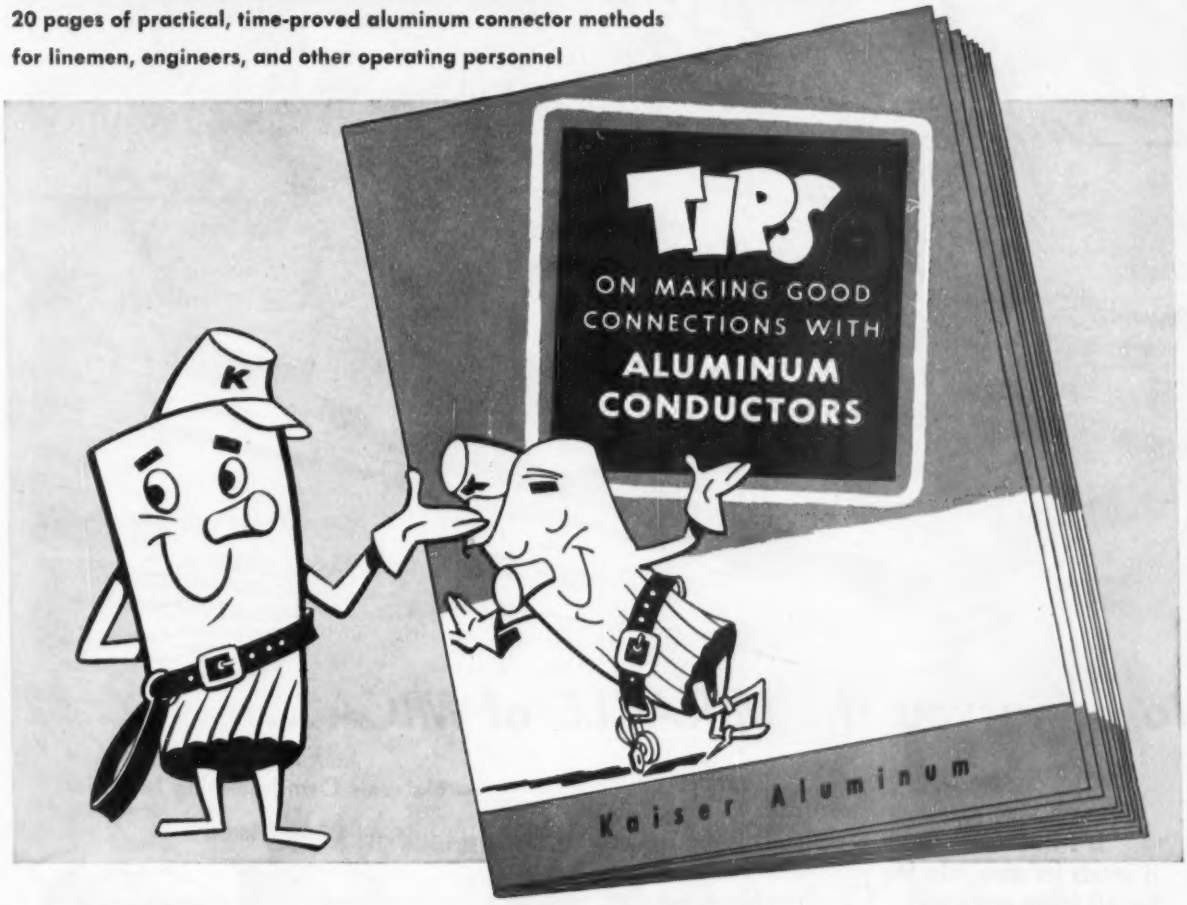
Your nearby Allis-Chalmers district office can supply you with complete information on distribution regulators. Call them or write Allis-Chalmers, Milwaukee 1, Wis.

A-4184

ALLIS-CHALMERS

FREE BOOKLET !

20 pages of practical, time-proved aluminum connector methods for linemen, engineers, and other operating personnel



Here are a few of the many questions answered by this valuable little booklet:

- Why use inhibiting compounds?
- Should both conductor and connector be wire-brushed?
- How much pressure is needed for a good connection?
- How can you increase the contact area at connections?
- When should spacers be used?
- What are the best methods of protecting against galvanic corrosion?
- How can moisture be kept out of connections?
- When should armor tape be used?
- Why should aluminum be above copper when connecting the two metals?

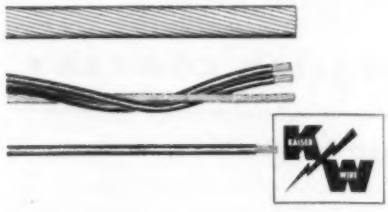
WHY YOU SHOULD ORDER SEVERAL COPIES TODAY! The rapidly increasing use of aluminum conductors means that *all* your construction people should be familiar with the information contained in the Kaiser Aluminum "TIP" booklet. Of course, it is not a complete treatise on connector methods, but its common-sense recommendations can help you get better connections that will give long, trouble-free service.

Order enough copies for everyone in the office and the field. Pass them out during your next training sessions. Use the coupon below as your order-form. For assistance or advice on a specific problem, call or write any Kaiser Aluminum office located in principal cities.

Kaiser Aluminum

setting the pace—in growth, quality and service

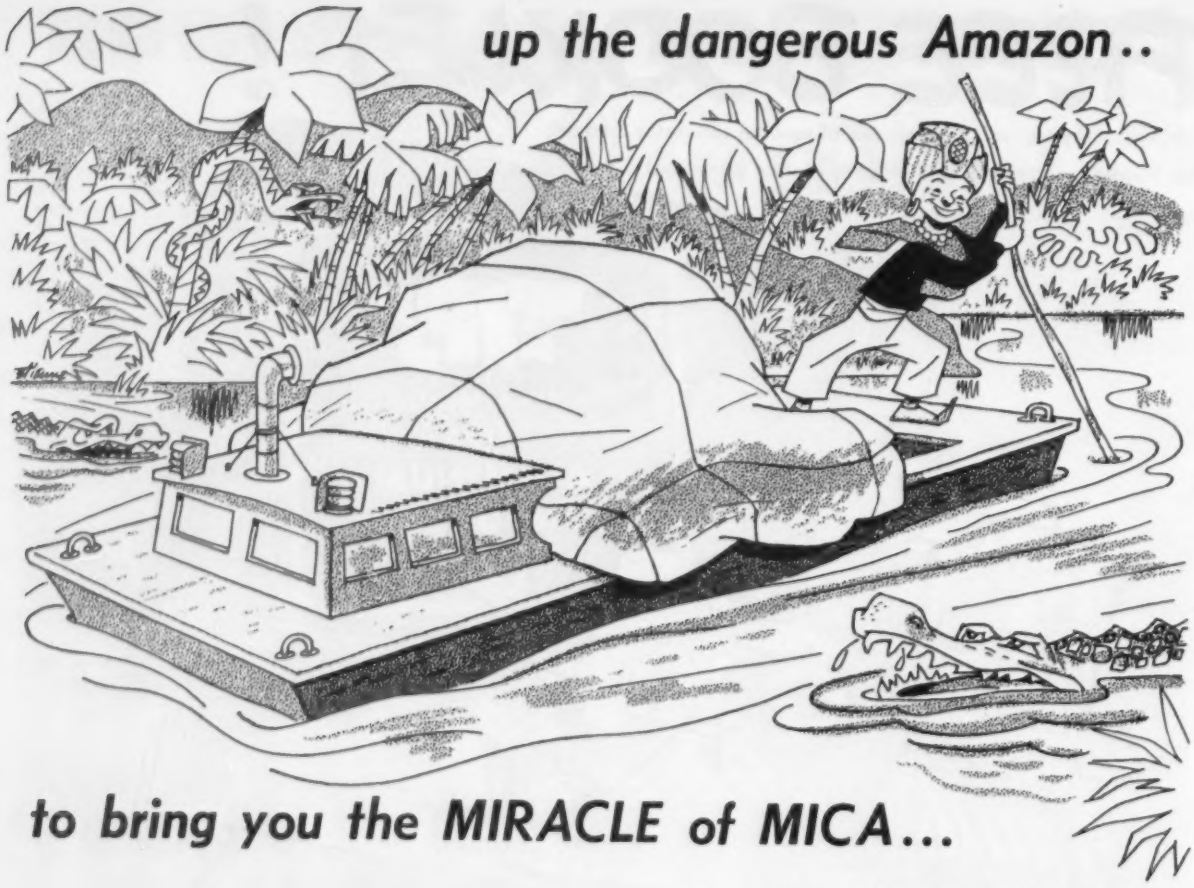
SOLID AND STRANDED NEOPRENE AND POLYETHLENE WEATHERPROOF CONDUCTOR
SELF-SUPPORTING TRIPLEX CABLE • ACSR • ALL ALUMINUM CONDUCTOR



Kaiser Aluminum & Chemical Sales, Inc.
1924 Broadway
Oakland 12, California.

Please send, at no obligation,_____ copies of booklet entitled "TIPS on making Good Connections with Aluminum Conductors."

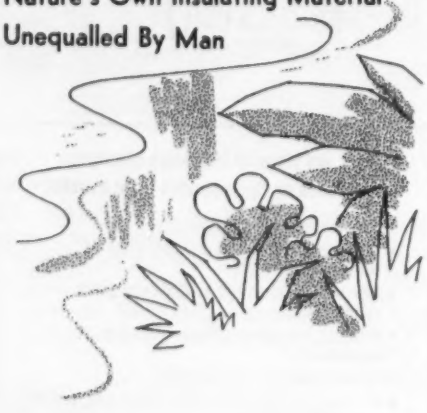
Name_____
Position_____
Company_____
Street Address_____
City and State_____



up the dangerous Amazon..

to bring you the MIRACLE of MICA...

— Nature's Own Insulating Material Unequalled By Man



It's because Macallen goes after the best Mica that it sends its men into the jungles of Brazil . . . yes, and to far-off India and Korea . . . even to the sub-Arctic reaches of Canada, wherever the best Mica is to be found. Sometimes it must be brought out by pack train, by bullock cart or river barge, as down the treacherous Amazon. Whatever the trouble or risk, it's worth it.

For Mica is the one natural insulating material, combining high dielectric properties and high resistance to heat to a degree unequalled by any man-made product. And Macallen engineers, backed by Macallen's sixty years' experience as Mica Headquarters, know best how to select, shape and form it ready for assembly. Why not consult them regarding your insulation problems? Inquiries invited.

when you think of MICA . . . think of MACALLEN

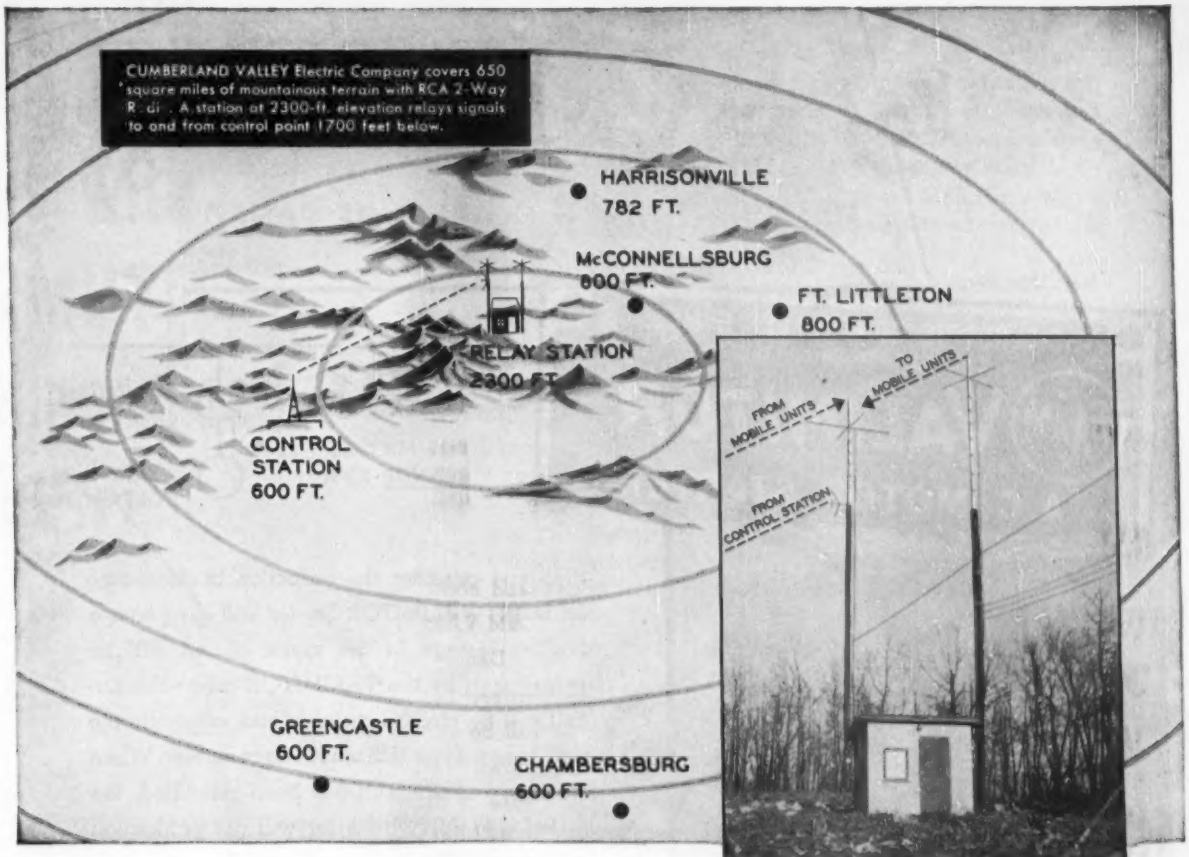
MACALLEN MICA

ALL FORMS, ALL QUANTITIES — ALL DEPENDABLE

THE MACALLEN COMPANY

BAY ROAD, NEWMARKET, N. H.

CHICAGO: 565 W. WASHINGTON BLVD. • CLEVELAND: 1231 SUPERIOR AVE.



HILLTOP RELAY STATION receives signals from control station on 73.98 mc. and from mobile units on 48.54 mc. Station transmits on 37.58 mc.

RCA 2-Way Radio raises Cumberland Valley 1700 feet

VHF radio relay has recently converted a difficult piece of terrain into ideal radio territory for Cumberland Valley Electric Company, of Mercersburg, Pennsylvania.

Working with RCA communications men, Cumberland Valley engineers virtually lifted the utility's headquarters from its valley site, and placed it on a hilltop seven miles away. From this vantage point the company achieves unusual efficiency, over its 650 square-mile service area.

In addition, the installation permits twenty-four-hour communication between mobile units without requiring a twenty-four-hour dispatcher. Superior car-to-car communication, provided by the hilltop relay, keeps crews in direct contact with each other during dispatcher's off-duty hours.

For engineering assistance on difficult communications problems, contact the RCA Communications Specialist at your local RCA Regional Office. For day-in, day-out dependability, specify RCA 2-Way Radio. For Literature... clip coupon below, and mail it today.

RCA®

RADIO CORPORATION of AMERICA
COMMUNICATIONS EQUIPMENT CAMDEN, N. J.

Radio Corporation of America
Communications Equipment, Dept. AB45
Building 15-1, Camden, New Jersey

☐ Please send me information on RCA 2-Way Radio.

☐ Please have an RCA Communications Specialist call on me.

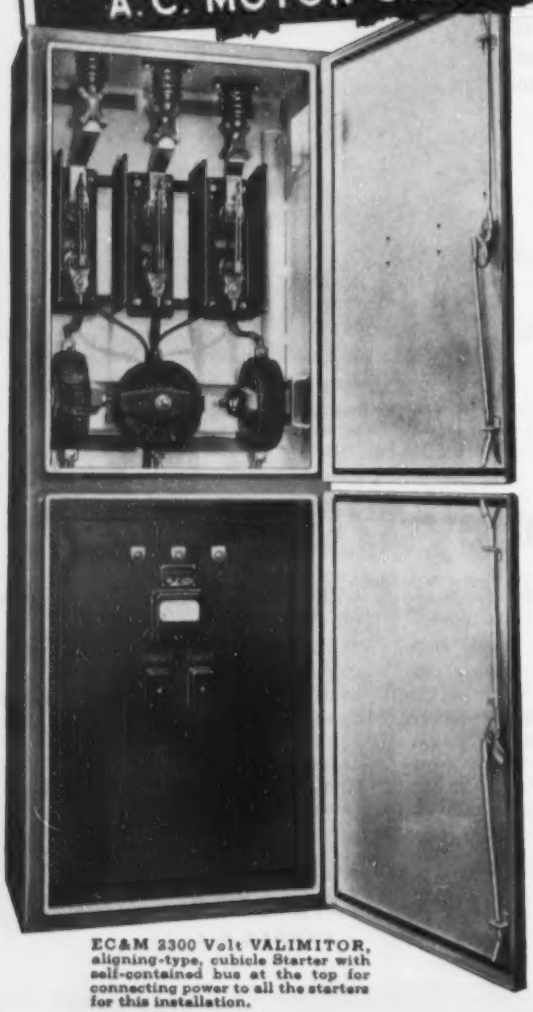
Name_____ Title_____

Company_____ Address_____

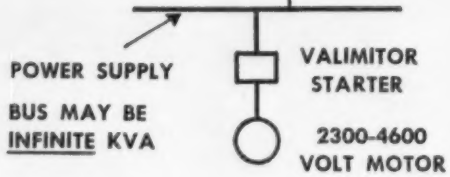
City_____ Zone____ State_____

RESTART in a matter of seconds -- no parts to replace --PAYS for itself, if there's *ONE FAULT*

THE ELECTRIC CONTROLLER & MFG. CO.
CLEVELAND, OHIO U.S.A.
E&M VALIMITOR
TRADE MARK
A.C. MOTOR STARTER



EC&M 2300 Volt VALIMITOR, aligning-type, cubicle Starter with self-contained bus at the top for connecting power to all the starters for this installation.



Stop and consider the reduction in down-time an EC&M VALIMITOR Starter will *save* after a fault. Damage in the motor circuit will be *minimized* by the VALIMITOR coils--the circuit will be cleared *quickly* and *safely* by the well-known Type ZHS magnetic contactor. When the cause of the fault has been remedied, the EC&M VALIMITOR starter will get production rolling again in a matter of seconds.

And EC&M VALIMITOR Starters are easy to apply on a system of *any* capacity. No need to figure "short" capabilities of existing bus including estimate for future growth. These starters may be applied to a bus of infinite KVA . . . fault currents will be limited to a maximum of 25,000 KVA (steady state current) and the EC&M Type ZHS Contactor of 50,000 KVA interrupting capacity clears the circuit quickly.

Remember that EC&M VALIMITOR Starters save time . . . in application . . . in installation . . . in restarting after a fault.

Write for **T9-117**

Reprint Bulletin

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79TH STREET • CLEVELAND 4, OHIO

Preventing high-volt leaks with PERMUTIT demineralized water

THE 75′ diameter atomic accelerator shown below has five times more power than any other. Its 2200 ton electromagnet quickly whips particles three million times 'round the racetrack to an energy approaching 3 billion electron volts.

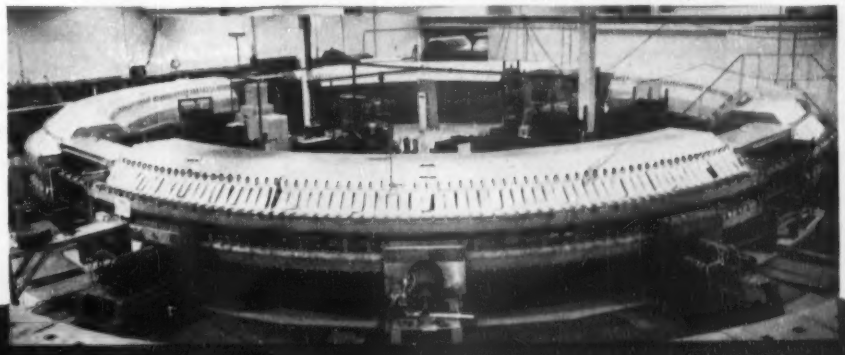
Packing all this power into a reasonable-size unit was a problem. Size ruled out air cooling. So the bus-bar magnet coil was made for circulating cooling water.

But at 3,000 volts, the dissolved minerals in *untreated* cooling water could conduct electricity, causing appreciable leakage to grounded piping. A means had to be found for producing water purer than conventional distilled water—at low cost.

A Permutit Demineralizer was selected *(see diagram)*. Cooling water recirculated through this ion exchange unit approaches the very low conductivity of pure water, hence it has been completely effective in removing dissolved solids.

Find out how Permutit can solve your water problems. Write to THE PERMUTIT COMPANY, Dept. EW-1, 330 West 42nd Street, New York 36, N. Y., or Permutit Company of Canada, Ltd., 6975 Jeanne Mance Street, Montreal.

The giant Cosmotron at Brookhaven National Laboratory.



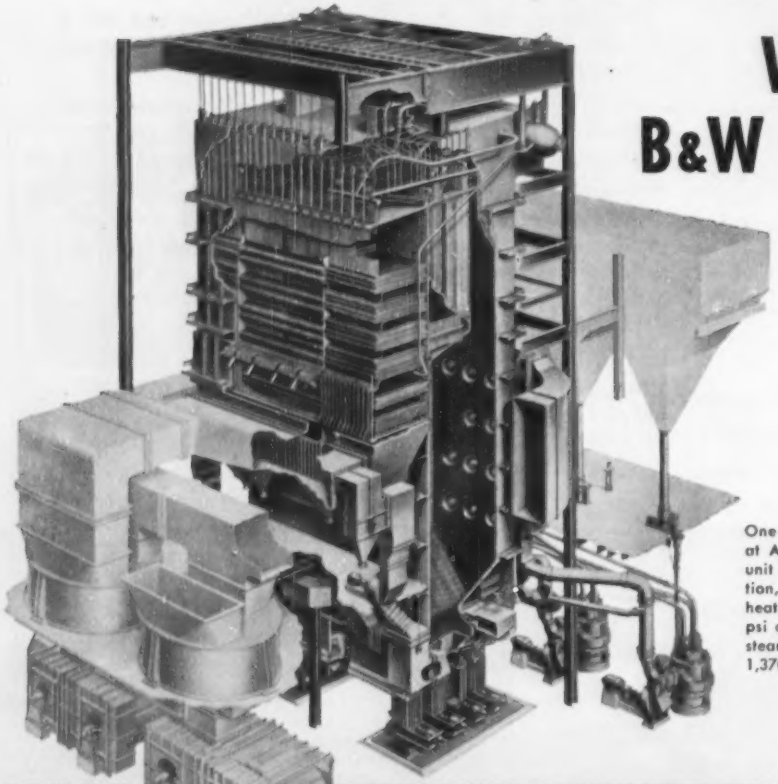
Permutit two-step Demineralizer with Vacuum Deaerator. Troublesome cation impurities are removed in the first step, remaining minerals in the second, oxygen and CO_2 in the final.

PERMUTIT®

ION EXCHANGE AND WATER CONDITIONING HEADQUARTERS FOR OVER 40 YEARS

Astoria Station

With More B&W Pressure-Fired Boilers



One of two Pressure-Fired B&W Boilers installed at Astoria. This dry-bottom, Radiant Reheat Type unit incorporating B&W Divided-Furnace construction, has a design pressure of 2050 psi. Superheater outlet pressure and temperature are 1850 psi and 1000 F, with reheat to 1000 F. Designed steam output ranges between 1,200,000 and 1,370,000 lb per hr, depending upon type of fuel.

Astoria Generating Station of Consolidated Edison Co. which will ultimately have a generating capacity of about 1,000,000 kw.

Goes on the Line

New from foundations to stacks, Astoria Station of the Consolidated Edison Co. of New York, Inc. represents a considerable advance in steam-electric power generating facilities. Significant features of this modern station include Pressure-Firing, one boiler-per-turbine, Cyclone Steam Separators for natural circulation, extra-fast starting of boiler and turbine, above-normal-capacity auxiliaries, and automatic shut-down protection.

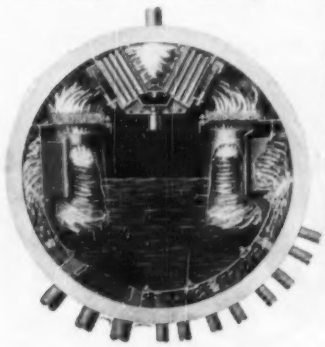
Pressure-Fired Boilers

The two Pressure-Fired B&W Boilers are the largest units in the world without induced draft fans. Pressure-Firing was selected for this station on the basis of service-proved economies and advantages. These include:

1. Greater efficiency due to elimination of air infiltration with consequently lower stack loss.
2. Elimination of cost of induced draft fans with attendant controls, foundations, and ducts.
3. Savings in installed kilowatts for auxiliaries.
4. Savings in operating power needed for fans.
5. Reduced maintenance due to elimination of induced draft fans.
6. Smoother operation, simpler controls, and easier starting with only forced draft fans.

Natural Circulation with Cyclone Steam Separators

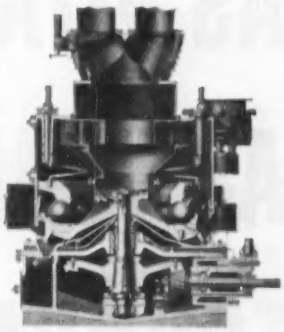
B&W Cyclone Steam Separators in the steam drum do a two-fold job. Separation of circulating water from steam is virtually one hundred per cent, thus assuring a high circulating head at all times. In addition, the Cyclones, in conjunction with steam scrubbers, help maintain turbine efficiency and reduce turbine maintenance by delivering steam of extremely high purity.



Building Saving with Divided-Furnace Construction

The simple B&W Divided-Furnace construction makes it feasible to achieve the required furnace cooling surface without an excessive increase in building volume. Substantial savings in steel work and other structural components are made possible.

Type EL Pulverizers and Multi-Fuel Burners



Each unit is served by five B&W Type EL Pulverizers which utilize the ball bearing principle of grinding. There are 22 circular burners suitable for use with oil, gas, or coal on each unit. Low maintenance is an outstanding feature of the EL Pulverizer which has long-life grinding elements made of a special abrasion-resistant material. Designed for ease of operation and simplified control, this design of pulverizer satisfies every requirement for economical, efficient direct-firing of pulverized coal.

* * * * * * * * * * * * *

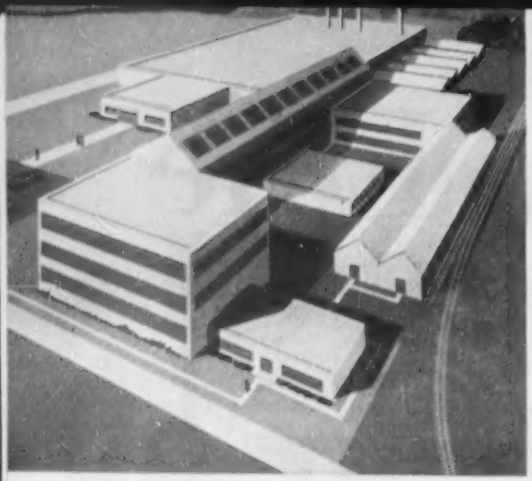
These and many other B&W engineering advances developed to increase the efficiency of steam generation are providing satisfactory and economical central-station and industrial service in plants across the country.

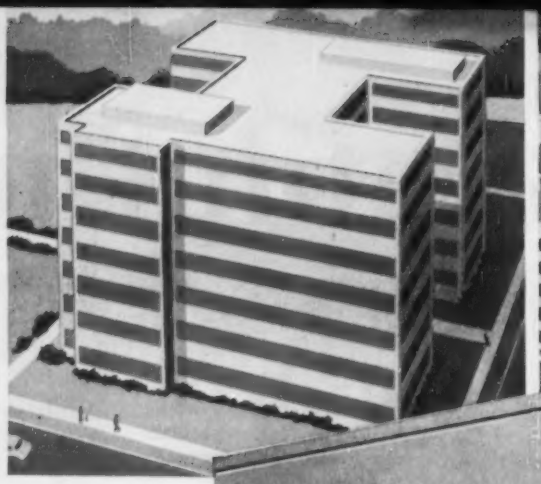
We will be glad to discuss them in terms of your future plans for boiler replacements or additional plant. For a detailed description of the features incorporated in Consolidated Edison's new Astoria Station, write for Bulletin 3-560. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

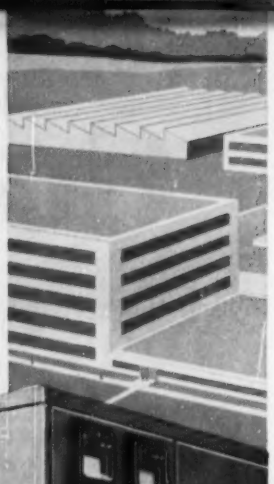
BABCOCK & WILCOX

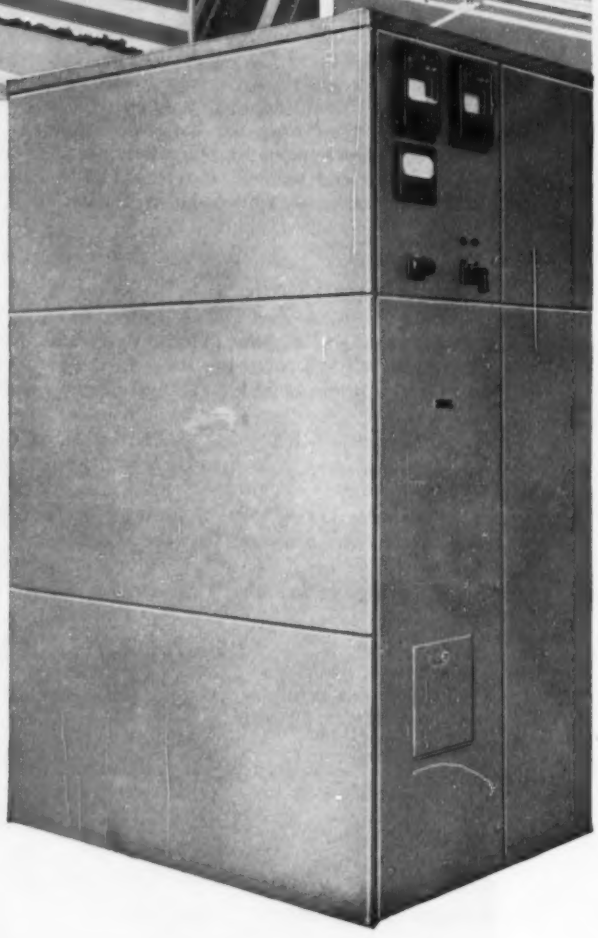
BOILER DIVISION

G-420





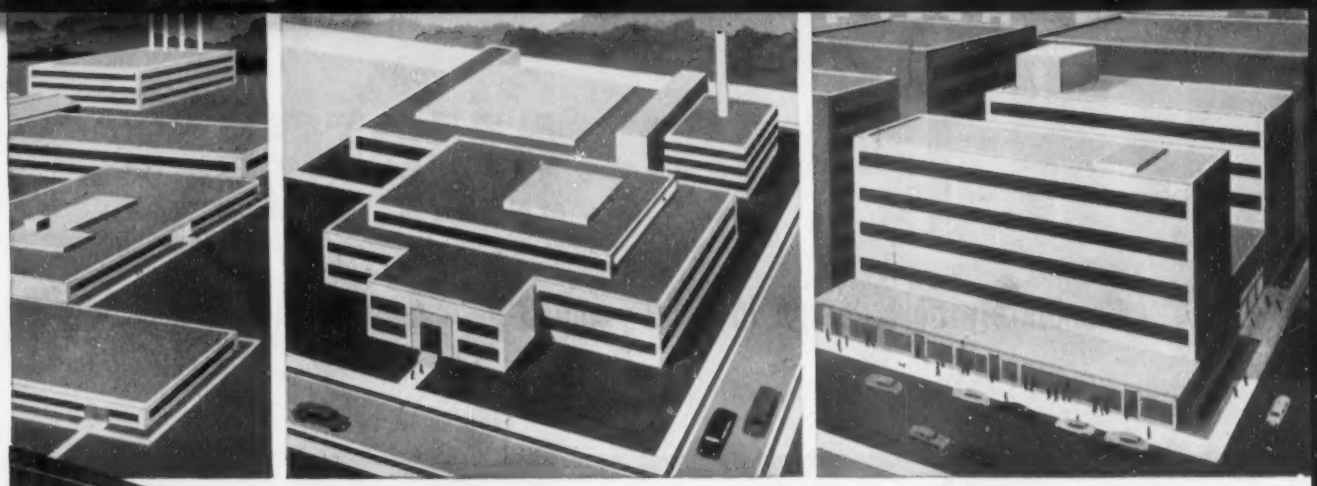


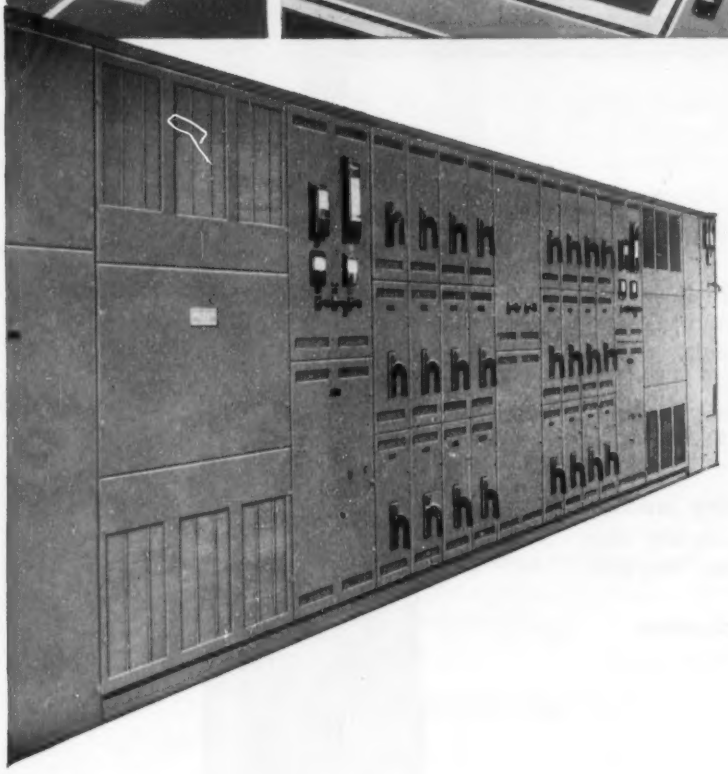


AS VITAL AS YOUR PLANT'S FOUNDATION

unit substations are basic plant investments

In central stations, industrial plants, or buildings—engineering management recognizes the need for power distribution equipment which is safe, dependable, economical, and adaptable. To Unit Substations, forming the *nerve centers* of any distribution system, is delegated the important responsibility of providing continuous power and circuit protection for years to come. Unit Substations, therefore, should not be merely *adequate*, but they must have quality to be a sound, *profitable* capital investment.





I-T-E offers a complete line of quality unit substation equipment

Through the years, I-T-E has led in the development and manufacture of quality circuit breakers and switchgear. Similarly, since the inception of the Unit Substation, and its use in modern distribution systems, I-T-E has continued to hold this same envied position. Today, I-T-E supplies a full line of quality Unit Substations, in types and sizes to fit every application.

As an *extra service*—to help users make the wisest investment possible—I-T-E furnishes engineering assistance in the selection and application of equipment, preparation of specifications, and coordination of all job requirements. There are I-T-E Application Engineers in every major industrial area for this purpose.

To find the I-T-E field office nearest you, look in the classified section of your telephone directory under "Electrical Equipment."

I-T-E Circuit Breaker Co., 19th and Hamilton Sts. Philadelphia 30, Pa.

UNIT SUBSTATIONS

NEW I-T-E 100-AMPERE "E"

Completely new design in 1-, 2-, and 3-pole construction!

All these I-T-E quality features:

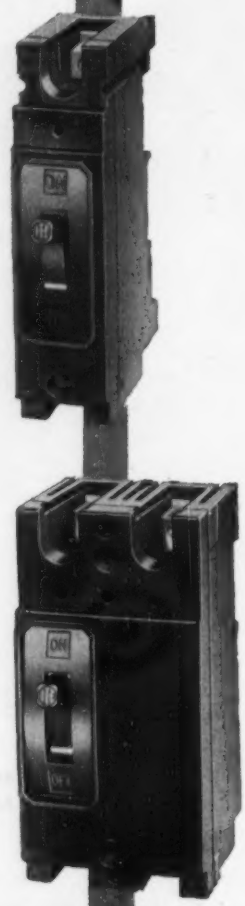
1 ***Thermal-magnetic tripping***
gives complete protection against overloads and short circuits.

2 ***Quick-make, quick-break contact action***
assures long breaker life.

3 ***"Common trip" operating mechanism***
opens all poles simultaneously when there's an overload on any one pole.

4 ***"Trip-free" handle mechanism***
prevents breaker from being closed against faults.

5 ***Three-position handle***
indicates whether breaker is ON, TRIPPED, or OFF.

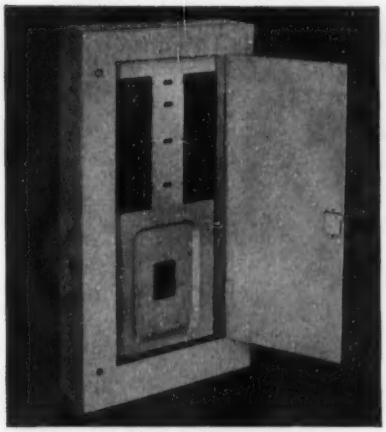


Available in ratings from—

15 to 100 amperes
1 pole: 125 volts a-c, d-c
2 pole: 250 volts a-c, 125/250 volts d-c
3 pole: 250 volts a-c, 125/250 volts d-c
5,000 amperes interrupting capacity

I-T-E

FRAME CIRCUIT BREAKER



For switchboards, panelboards, power panels

Saves space
through compact over-all design and mounting arrangements.

Simplifies mounting
in switchboards by use of rear connection studs. Easy front removal of breakers. Safe. Saves time.

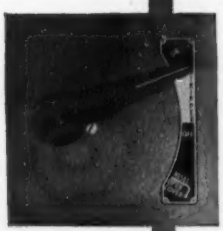
Provides ample bussing space
to accommodate required copper bus. Enlarged pole spacings designed into breaker case.

For all types of individual enclosures

New "E" frame design now provides up to 100 amperes capacity for individual enclosure mounting. Breaker is easy to wire. Solderless pressure-type terminals are easily accessible . . . convenient to use.

For fluorescent lighting applications
at 277 volts a-c, single-pole "E" frame breaker provides positive protection.

NEW I-T-E OPERATING HANDLE MECHANISM
allows breaker to be operated from outside steel cabinets and enclosures.



Attractive modern design features molded pistol grip handle.

Position indicator clearly shows when breaker is ON, TRIPPED, or OFF.

Interlock prevents opening door with breaker "on".

Easy installation. Instructions and drilling template supplied with mechanism.

Slam-proof. Shock resistant spring-loaded cam arrangement eliminates handle breakage.

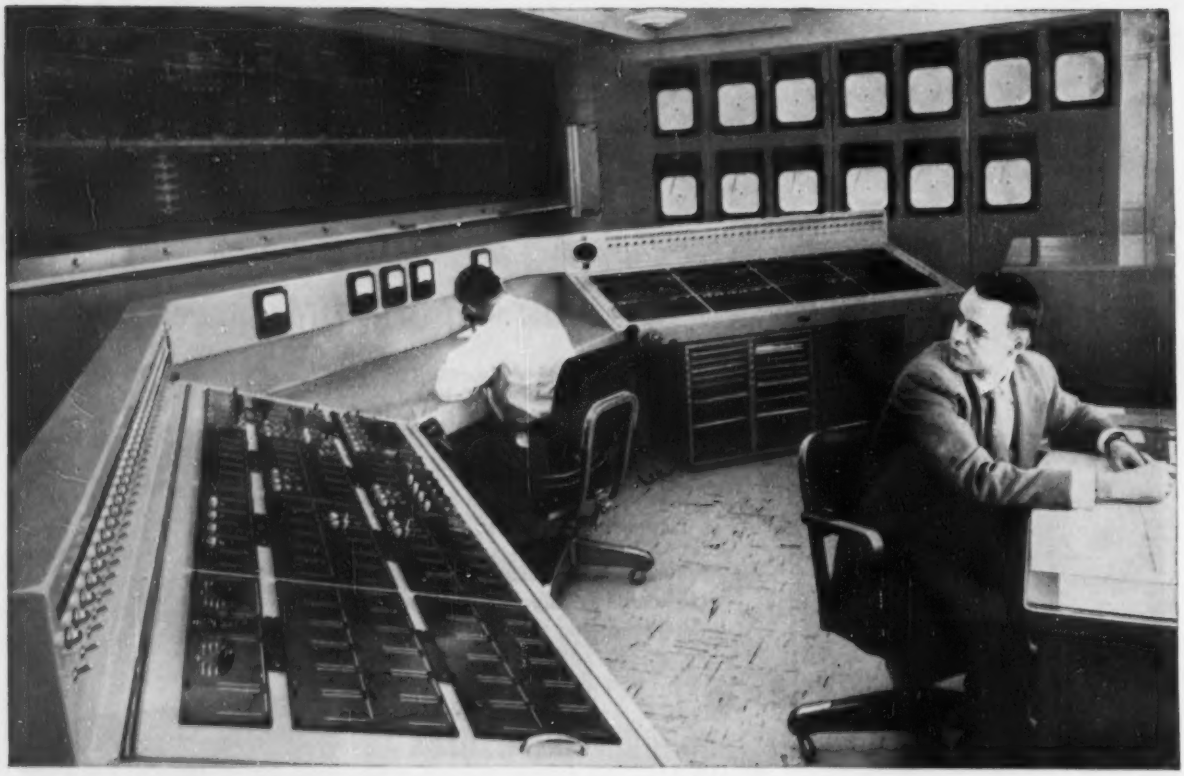
Self-centering design feature automatically engages breaker handle when mechanism is operated.

SAVE TIME, SAVE SPACE... WITHOUT SACRIFICING QUALITY

Standardize on I-T-E circuit breakers to assure service continuity, simplified maintenance, a single source for system expansion and—*always*—the same proved I-T-E dependability throughout.

For details, write to *I-T-E Circuit Breaker Co., 19th and Hamilton Sts., Philadelphia 30, Pa.*

Molded Case Circuit Breakers



1000 MILES AT A GLANCE

You are looking at the Platte Pipeline Company's communications system. 1000 Miles of super-efficient microwave, surveyed, designed, manufactured and installed by *Philco* . . . world's leading manufacturer of microwave equipment.

The entire 1000 miles of this new microwave communications and control system can be seen in a glance at this terminal control board in Kansas City, Missouri. All functions of the pipeline can be observed and controlled at this point . . . The operation of pumps and compressors, the pressures and flow rates of oil, telegraphic printers, VHF mobile and stationary radio, even the operation of the microwave system itself.

Philco microwave provides complete communications and control for this giant pipeline with greater reliability and less maintenance cost than could be obtained from any other type of system.

For Complete Information Write to Department ***EW***

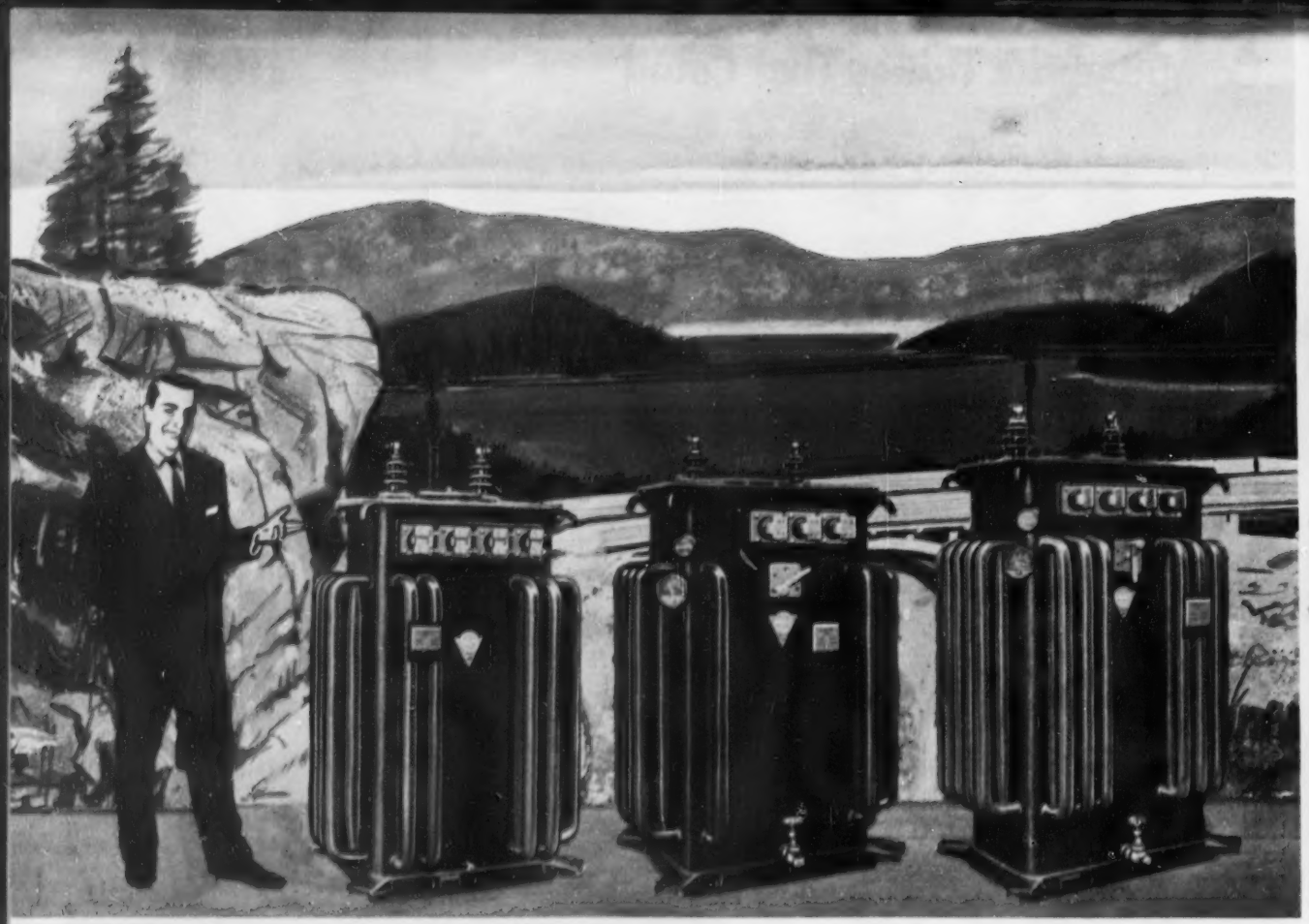
PHILCO Famous for QUALITY the World Over

PHILCO CORPORATION

GOVERNMENT & INDUSTRIAL DIVISION

PHILADELPHIA 44, PA.

Compare the Things That Count
L-M's New Large Round-Wound Transformers Are 20% Lighter... Exciting Current Is 70% Lower
New 167 kva • 250 kva • 333 kva • 500 kva
New Fifth Report Standard 167 to 500 kva Round-Wound transformers offer uniformly high impulse strength and high short-circuit strength, improved regulation, lower overall losses, low exciting current, excellent overload capacity.
L-M's new 167 kva Round-Wound transformer is lighter for easier and safer pole mounting.
LINE MATERIAL
Transformers
LM



The four new large Round-Wounds. Left to right, 167 kva, 250 kva, 333 kva, and 500 kva. Units are available in all standard voltage ratings through 14400 volts. The table gives the dimensions and weights of units rated 7200/12470Y to 120/240 volts on the 167 kva size and 240/120 volts in larger ratings.

KVA	Overall Height	Overall Width	Overall Depth	Total Net Weight lbs.
167	66⅞"	40⅞"	25⅞"	2100
250	69⅞"	44"	32"	2850
333	73¾"	46"	38⅛"	3650
500	79"	54"	43"	4650

L-M's New Large KVA Round-Wound Transformers Are 20% Lighter; Exciting Current Is 70% Lower

By **ALVIN B. COYLE,**
Manager,
Transformer Sales
Line Material Company

To meet the new standards recommended by the EEI-NEMA committee's Fifth Report, a number of design changes have been made in L-M's 167 to 500 kva transformers.

Along with these changes, we have completely redesigned the line in all voltage classes to take full advantage of the inherent qualities of the Round-Wound style of design, an L-M exclusive.

20% Lighter

The result is a line of transformers that offers many distinct advantages to our customers. For example, our new designs average 20% less weight than our old designs.

Cores are of oriented grain cold-rolled silicon steel strip. Taking full advantage of this steel by the Round-Wound design is an important factor in this weight reduction.

Exciting Current 70% Lower

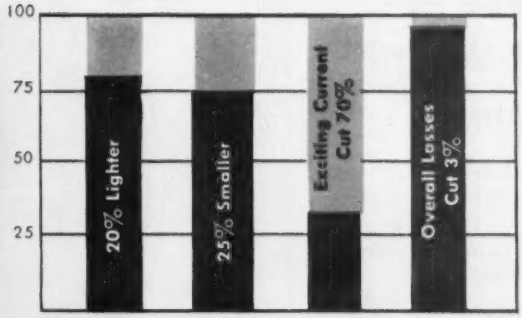
Exciting current has been reduced 70%, a drastic reduction that obviously offers a desirable saving. Other losses have also been reduced. On the average, total losses are down about 3% from those of our older designs, which is a further reduction in losses that were already remarkably low. This reduction in losses has been accomplished coincidentally with reduced size, lower exciting current, and other improvements.

Excellent Regulation

A low value for regulation dictates a low impedance. Conversely, a high impedance contributes to improved short-circuit strength.

The new large kva Round-Wounds are designed to give the best regulation compatible with the other desirable performance characteristics. This is an example of L-M's "Balanced Performance" design.

Compare the Things That Count



Bars show average improvements in new Fifth Report designs over our own previous 167 to 500 kva transformers.

20% Lighter: weight has been reduced on the average of 20%. The 167 kva can now be pole-mounted more safely and easily.

Sizes Reduced Up To 25%: with the new design, size has also been reduced.

Exciting Current Cut 70%, with the new design.

Overall Losses Cut 3%: losses that were already low have been further reduced.

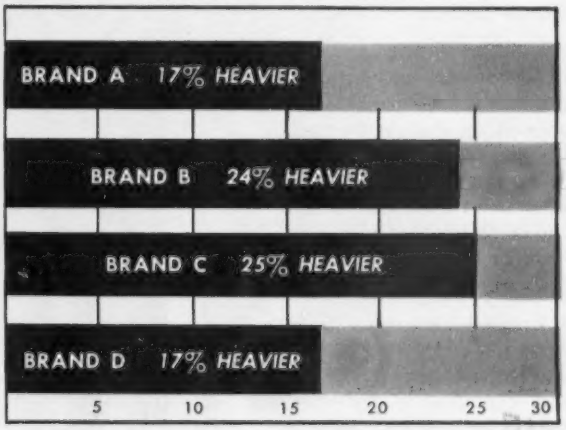


Chart shows how much heavier four other well-known makes of transformers are than the new L-M. Figures are based on the 500 kva, 7200/12470Y—240/120 volts. This is typical of weight comparisons on other ratings and voltage classes.

Uniformly High Impulse Strength

The excellent field record of the smaller sizes of Round-Wound transformers under all service conditions is a tribute to the basic principles of this efficient L-M style of construction. Uniformly high impulse strength and excellent overload capacity are fundamental to the Round-Wound transformer. The new large kva units have been designed to take full advantage of these very important characteristics.

Smaller Sizes

The new Round-Wounds in larger sizes are designed to give the most quality in the smallest and lightest package. The things that count have been given unlimited consideration in design and manufacture.

Let Us Tell You The Whole Story

Ask the L-M Field Engineer for descriptive literature and specifications of the new L-M Round-Wound transformers. Or write Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).

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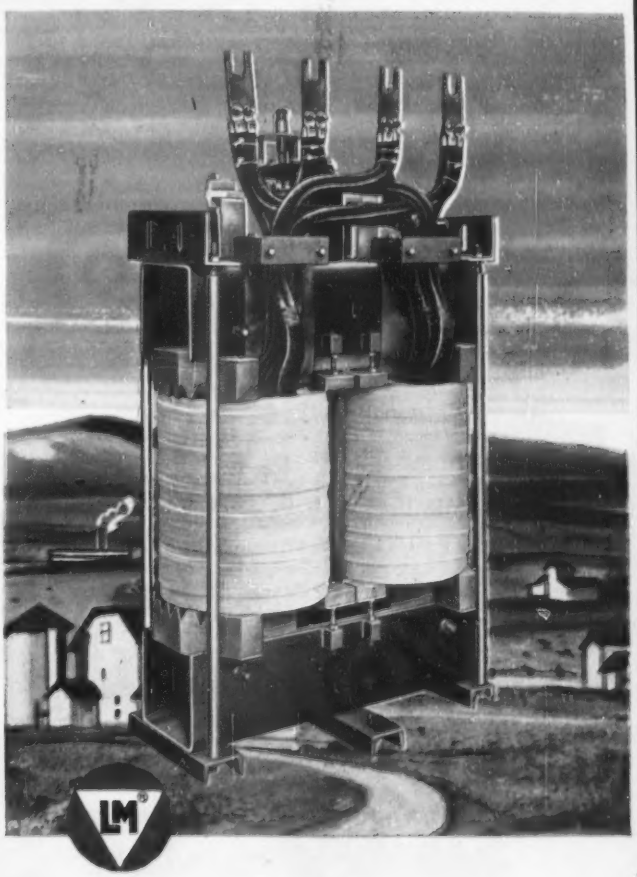
Core-Coil Assembly

Core and coil assembly of the new 500 kva Round Wound. Note the compact, strong construction; the ample surface exposed to cooling oil; the strong frame and heavy blocking for high short-circuit strength.

"Round-Wound" is a Line Material Company trademark



LINE MATERIAL Transformers

You Get Advantages Like These In L-M Round-Wound Transformers

Round-Wound construction consists of round coils, wound directly onto a wound core. The core is wound, then annealed. It is not cut, unwound or otherwise disturbed. L-M is the only manufacturer making a core this way. The result is a magnetic circuit with uniformly low excitation losses. Coils are wound directly onto the completed core by L-M's exclusive process. This construction offers many advantages.

Better Cooling—Higher Short-Time Overload Capacity

The long round coils present large, unobstructed surfaces to the cooling oil. In addition, the cruciform-cross-section core provides natural oil passages between coil and core for additional cooling. That is why, in the Round-Wound transformer, heat is dissipated more rapidly and more uniformly, providing higher overload capacity.

High Impulse Strength

The Round-Wound design has inherently strong insulation, and allows the designer to provide substantially longer creepage distances than is possible in other types of construction. Therefore, the Round-Wound design has uniformly high impulse strength, which is borne out by extensive laboratory tests and field service experience.

High Short-Circuit Strength

Round coils naturally resist radial short-circuit forces without distortion; and the heavy frame and strong blocking prevent axial movement of coils. Thus Round-Wounds have extremely high short-circuit strength.

"Balanced Performance"

Physical and performance characteristics are well balanced in the Round-Wound transformer. No one characteristic has been emphasized at the expense of another.

Get Complete Information

Ask the L-M Field Engineer for complete information on the construction and characteristics of L-M Round-Wound transformers; or write Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).

"Round-Wound" is a Line Material Company trademark

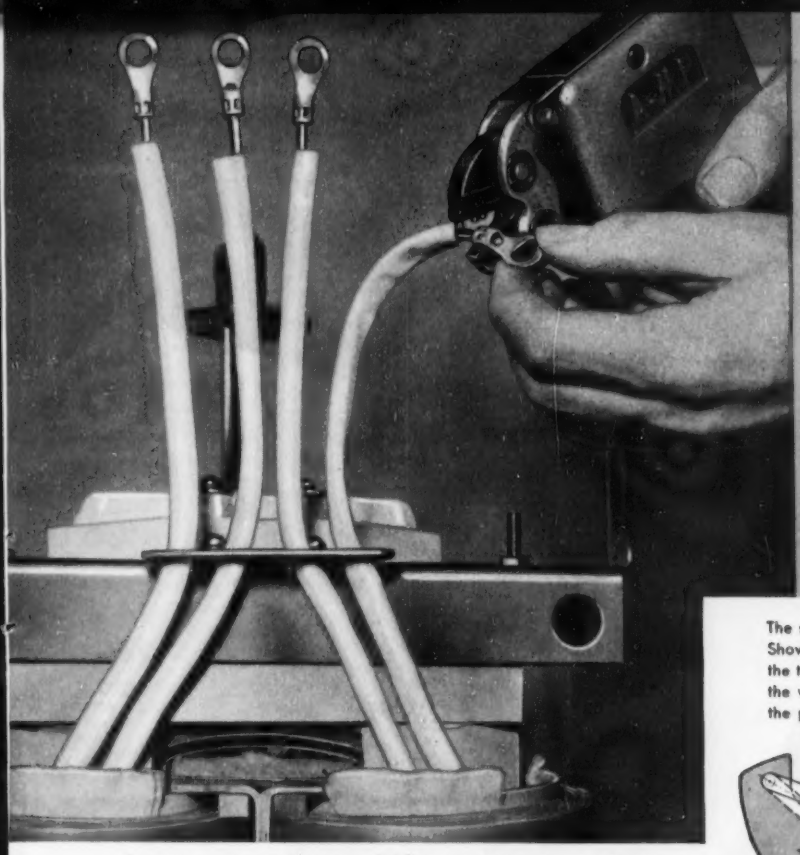
LINE MATERIAL

Transformers

Round coils are wound directly onto the completed core. The core is not disturbed, cut or disassembled after annealing. Coils surround a maximum of the magnetic circuit. They present a relatively large area to cooling oil.

Round-Wounds have high impulse strength, because they provide better insulation and longer creepage paths, as seen by comparing typical Round-Wound with typical shell-type construction.

Short-circuit strength is high. Round coils suffer no radial distortion, as compared with coils of rectangular cross section. Heavy steel frame, strong blocking, and varnish of extremely high bonding strength contribute to prevent axial movement under short-circuit stresses.

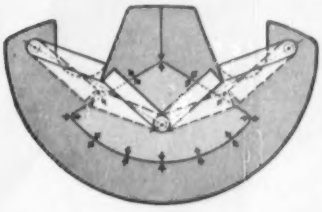


Connections are made by pneumatic hand tools which automatically put the proper pressure on the swaged joint. The W-crimp forms all strands and terminal into substantially one solid, low-resistance piece of metal.

Two solid wires secured in one terminal. As shown in the cross section, the copper fills the entire area, and any relaxation of the copper simply tightens the connection.

Two solid and one stranded wire secured in one terminal. All three are firmly held. The joint has less resistance than the conductors themselves, the wires cannot loosen, and the joint remains completely free from corrosion.

The sketch illustrates the "locked lever" principle utilized in the W-crimp. Shown outlined by solid lines are imaginary toggle arms which represent the theoretical condition existing prior to making the crimp. After crimping, the wire is locked in position by the deformed terminal, as illustrated by the position of the phantom toggle indicated by the broken lines.



Note how the toggle action of the W-crimp prevents the conductor from assuming its original shape, and any tendency toward cold-flow actually increases the pressure between the conductor and the terminal connector. The arrows indicate pressure exerted between the conductor and the connector.

W-Swaging Assures Strong, Corrosion-Proof Connections on L-M Round-Wound Transformers

by **R. W. BECKER**
Manager
Quality Control Department
Transformer Division
Line Material Company

Internal connections in our transformers must be strong, have low resistance, and be corrosion-proof. Some years ago we conducted extensive experiments with the usual methods—soldering, brazing, welding, and with a variety of swaged connectors.

Finally we standardized on the W-crimp type of swaging, a development of the Aircraft-Marine Products Company. L-M was the first transformer manufacturer to use this improved method. In nearly six years of use we have had practically no complaints because of connector failure.

In the W-crimp which we use, advantage is taken of the tendency of copper to "relax"—to resume its original form. After being deformed by the action of the precisely controlled indenting tool upon the connector and conductor, the conductor tends to cold-flow. However, through the scientific "locked leverage" principle utilized in the design of the terminal indentations, forces due to cold-flow in the conductor are so restrained that contact pressures are increased, and the resistance of the joint actually becomes lower as the swaged connection ages.

The advantage of this type of swaged connection is especially important where solid conductors are joined. These often show a tendency to loosen with other styles of crimped connections. Stranded conductors, relatively simple to join by other pressure-type connectors, are even more satisfactorily joined by W-crimps.

Principal advantage to the user of Round-Wound transformers is that he need not worry about internal connections. They do not pull out or break, even under most adverse conditions. The wire is not weakened by crystallization because no heat is required to make the joint. They do not corrode. There is no radio noise problem. Resistance is as low as, or lower than, the resistance of the wire itself.

This is one of many quality "extras" that may not be seen by the user but that have helped build the fine reputation of Round-Wound transformers for performance and long life.

Get Details on Construction of L-M Round-Wound Transformers

Ask the L-M Field Engineer for a copy of Bulletin DT1, which describes the manufacture of "Round-Wounds" or write Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).

"Round-Wound" is a Line Material Company trademark

LINE MATERIAL
Transformers

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THE Nicopress SLEEVE

WITH THE Nicopress TOOL

...GIVES YOU A PERFECT NICOPRESS SPLICE

For use on Copper, Copperweld, and All-Aluminum Conductors

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THE NATIONAL TELEPHONE SUPPLY COMPANY

Meet Al Schieber, Assistant Manager, Westinghouse Electric Utility Dept. On the next seven pages he leads a discussion on . . .

Guarding your high-cost equipment against damaging faults

A. L. Schieber has spent the last 40 years at Westinghouse helping solve utility problems. This insert covers "equipment that protects equipment" and Al has seen much of it develop from its beginnings as an idea in an engineer's mind.

"A new development promises to extend the usefulness of power line carrier in system protection. Frank Gunter of Carrier Engineering tells how . . ."

This new power line carrier equipment gives you more channels

On many systems there is a shortage of power line carrier channels for relaying, telemetering, load control, remote tripping and communication. The new FD equipment just developed packs more channels into the same frequency spectrum, gives you additional opportunities for system protection.

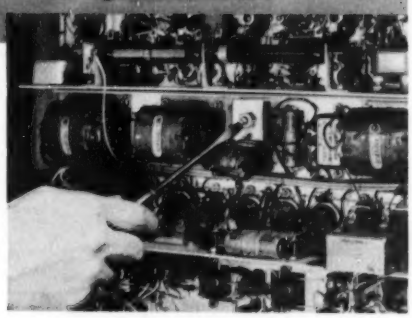
A combination of Westinghouse developments makes this possible. One of these is crystal control, which is used in the carrier transmitters to hold each channel exactly on frequency. Since one channel can't drift into another and create interference, the channels can be placed closer together. Spurious or harmonic outputs that are so characteristic of some electronic circuits have been reduced to a minimum in the FD equipment. This means less interference between channels—less need for space between channels—more room for additional channels. Coupled with these transmitter improvements are refinements in receiver selectivity, sensitivity and noise reduction. These receiver design changes contribute greatly to the more efficient use of the available frequency spectrum.

A very important feature of the new FD equipment is the frequency shift equipment (or assembly). The operator above is checking it with a frequency counter. Using this improved frequency shift apparatus, telemetering, supervisory control and remote tripping, each requires an r.f. bandwidth of only 120 cycles!

For additional information on how you can get more channels and more flexibility with type FD power line carrier equipment, write to Westinghouse Electric Corporation, Carrier-Microwave Section, 2519 Wilkens Avenue, Baltimore 3, Md.

YOU CAN BE **SURE**...IF IT'S

"Relays are basic to transmission protection . . . Bill Sonnemann, Manager, Relay Engineering, tells you about the latest relay developments."



A simple screw driver adjustment made in the field matches the HKB to extra-long lines.

Improved carrier relaying acts instantly to clear faults

A positive way to isolate faulted sections of a transmission line is provided by HKB carrier relaying. You can't buy better protection for your high capital investment in your transmission system. This relaying system compares conditions at the terminals of a section of line. Power line carrier equipment such as shown on the opposite page enables the relays to make this comparison. When a fault occurs *within* the protected section, breakers at each end are tripped simultaneously. This is desirable from the standpoint of stability, continuity of service, quick reclosing and minimum damage to equipment.

Westinghouse HKB carrier relaying has been improved by the use of vacuum tubes to replace the thyratrons formerly used in the control unit. The vacuum tubes are continuously grid-controlled, providing surer action. An added advantage is that the vacuum tubes may be tested at any time on conventional tube-testing equipment. Since weak tubes can be detected and discarded, you can be sure at all times that the equipment will work when it is needed.

The new control unit used with the Westinghouse HKB equipment contains a new phase-shifting network. This network may be adjusted to compensate for phase shift due to an extra-long transmission line. The adjustment may be made easily in the field and it adds considerably to the flexibility of the relaying system.

These improvements in the HKB relaying system are typical of the engineering developments that make Westinghouse a leader in the relay field. For more information on HKB carrier relaying and on other relaying systems, contact your Westinghouse representative.

J-40447

Westinghouse

"The power circuit breaker is the key to modern system protection. Jack Stirling discusses . . ."*

De-ion interruption . . . key element in modern breaker design

Here is one of the most important developments ever made for system protection—the De-ion* grid which is standard on all Westinghouse power breakers. These breakers, being mechanically as well as electrically *trip free,* insure top-speed contact separation after reclosing as well as initially on a fault.

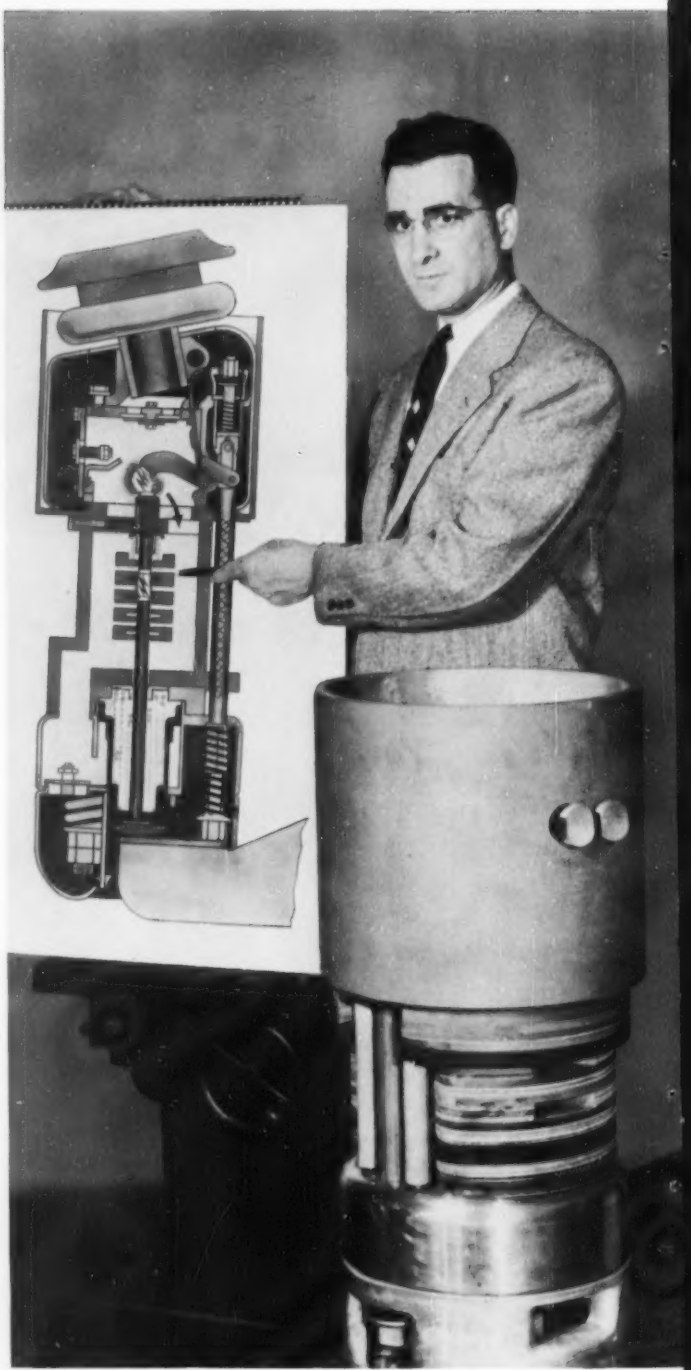
In this high-capacity, high-voltage De-ion grid, the arc literally snuffs itself out. The multi-flow principle limits arcing to one cycle, or less, and total clearing over the entire current range is *not more than three cycles.*

Even when the breaker is reclosed in 15-20 cycles, the De-ion grid has been completely scavenged of arc products making it ready for an immediate 3-cycle interruption if necessary. This high-speed isolation of faults, and high-speed reclosing ability, not only protects your equipment, but also improves your system operation.

For the past 28 years, the designers of Westinghouse breakers have had an invaluable tool—the famous High Power Laboratory. It means that every rating of breaker is thoroughly proved to give you the high level of protection you require.

When you're planning a new breaker installation, call Westinghouse early or write now for Descriptive Data 33-160. J-60832

*Manager, Power Breaker Application Engineering



YOU CAN BE **SURE**...IF IT'S

"Here's Jim Ford, Manager, Manufacturing Engineering, who points out one of the basic reasons for reliability in Westinghouse instrument transformers."

Power factor control means added reliability in instrument transformers

Obviously, the larger your investment in capital equipment, the more you must be sure of reliability as well as accuracy in your instrument transformers. Here's an example of Westinghouse practice which assures vital reliability. . .

Materials having an insulating job to do—including oil, Inerteen®, pressboard, paper and similar insulating materials are given extensive quality checks including power factor.

Insulation when stressed may tend to heat up due to power-factor losses. This heating in turn increases the power factor which again increases the loss. If the power factor is controlled within permissible limits for the application, the losses can be dissipated before this destructive cycle can start . . . and, more importantly, before your equipment is affected.

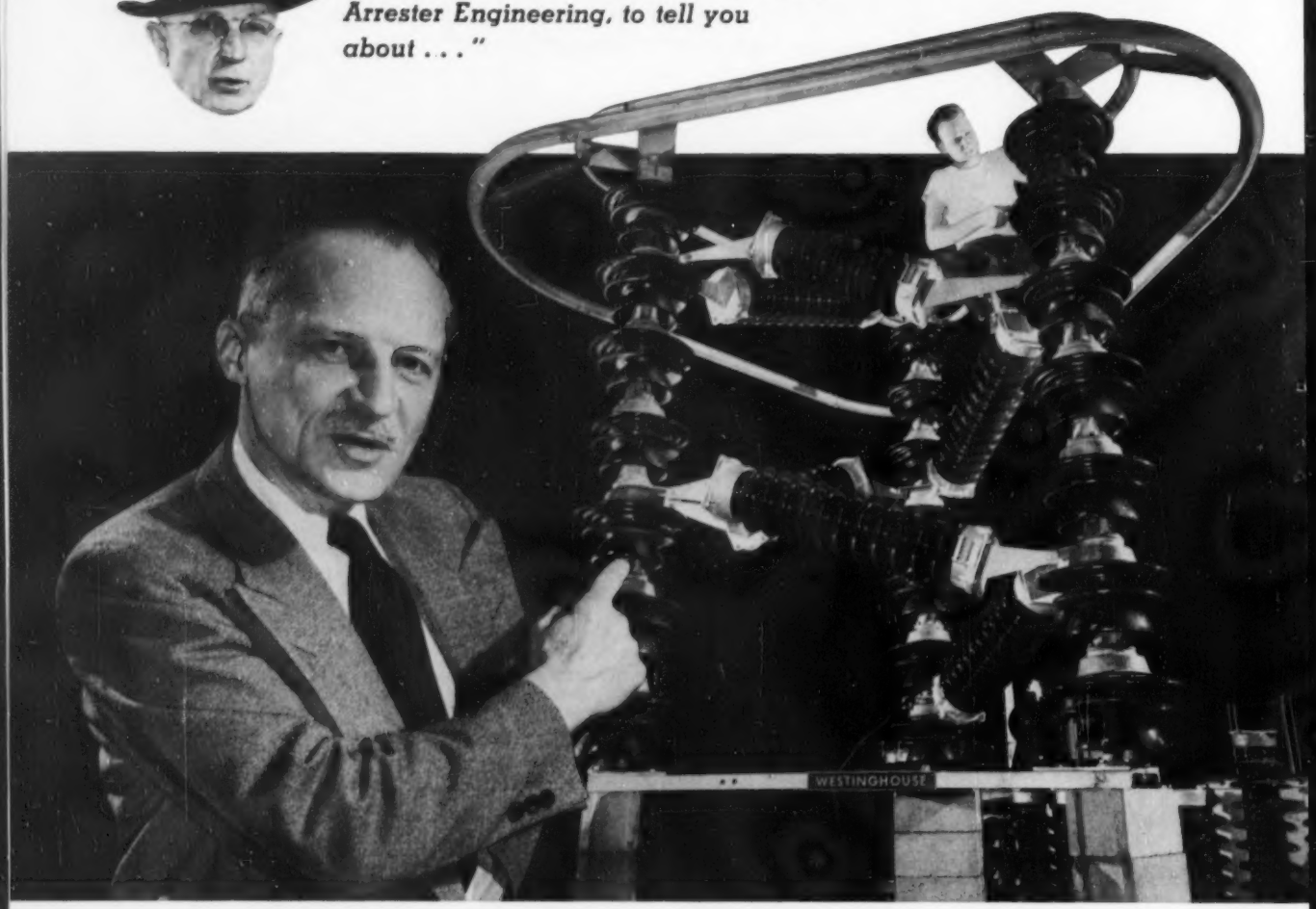
Westinghouse has steadily improved the control and application of materials used in its apparatus to assure satisfactory operation of modern Westinghouse instrument transformers.

This excellent control of the quality and use of materials, plus the superior quality of Hipersil® cores and oxygen-free copper, make Westinghouse instrument transformers the best on the market for reliability and sustained accuracy. The sealed indoor and outdoor vacuum-pressure, plastic-filled units pioneered by Westinghouse, and the sealed oil-insulated outdoor units are typical plus values for service continuity.

If you are interested in how Westinghouse instrument transformers can add to the protection of your high capital investment, call your nearby Westinghouse representative. J-70695

Westinghouse

"Here's Ed Beck, Manager of Lightning Arrester Engineering, to tell you about . . ."



Unique new tripod design . . . Better lightning protection at 230 kv and up!

With its new tripod mounting, the Westinghouse SV arrester now provides even better protection against lightning surges for systems rated 230 kv and up. The more compact design results in better voltage distribution along the arrester. This minimizes the distorting effect of the electrostatic field and maintains high surge discharge characteristics.

The more compact design also eliminates the need for supporting towers and saves installation costs. And substation designers will like the lower overall height.

The surge capacity and characteristics of Westinghouse SV arresters exceed industry standards. No modern power transformer has *ever* been damaged by lightning when protected by an integrally-mounted SV arrester.

Westinghouse, in cooperation with many utilities, has been foremost in the study of lightning phenomena since 1926 when the Westinghouse Klydonograph made possible the original lightning studies.

Your expensive equipment deserves the high level of protection available in the SV arrester. Write for bulletin DB-38-120.

J-60831

YOU CAN BE **SURE**...IF IT'S

"The protection of low-voltage circuits took a big step forward when Westinghouse developed the DB breaker. M. E. Horn discusses . . ."*

Instantaneous protection and delayed tripping . . . just the combination you need

The DB breaker contains a multi-purpose tripping mechanism which . . . (1) provides delayed tripping on temporary overloads, (2) trips on larger overloads before damage can be done, and (3) trips instantly on short circuits.

This single tripping mechanism has a wide combination of settings for delayed and instantaneous tripping. You can easily adjust it to provide the best protection and most practical operation for *your particular job.*

Here is the kind of operation this flexibility permits. You can install 50-amp breakers nearest the load and back them up with 225-amp breakers. A 600-amp breaker would supply the system. Now by proper coordination, a 50-amp breaker will trip on overload while the rest of the system keeps functioning.

DB breakers are built from highly flexible subassemblies and are designed for mounting in switchgear assemblies. Single circuit breakers are available in a variety of enclosures: such as general-purpose, weatherproof, explosion-proof, etc.

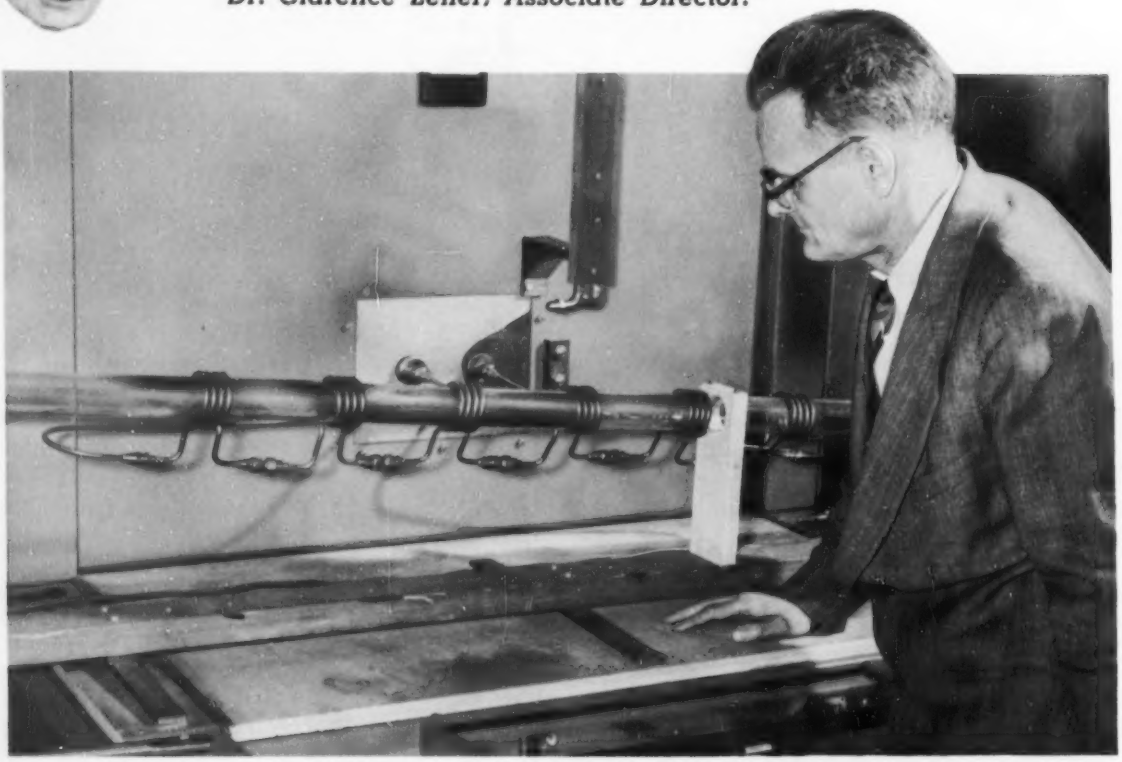
Get more information on these outstanding breakers. Write now for Booklets 4067 and 4740.

J-60830

*Manager, Low-Voltage Air Breaker Engineering

Westinghouse

"Most of the products discussed here have their roots in the exciting atmosphere of the Westinghouse Research Laboratories. Here's Dr. Clarence Zener, Associate Director."



For better system protection: Germanium 99.99999999% pure!

Here is a good example of what we call *basic* research—developing new materials and processes to improve the equipment we build. This laboratory process precipitates germanium that contains only one part impurity in ten billion!

We're using this intensely pure material in studies of "semiconductors", such as the wonderful new transistors which have such great application to relaying, microwave and other system protective devices.

Basic research accounts for about 50% of our activity. Another 40% is devoted to *fundamental* research—pure science which operates on the frontiers of human knowledge. In recent years, we have done a great deal of work in "solid state physics" which embraces semiconductors.

We expect our work to continue as a keystone in solving system protection and other utility problems. CP-1007 CP-4

For more information on the products described in this 8-page advertisement, write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

Basic research has really paid off in lightning arresters. We developed the Rutile Button which produces ionization in the spark gap at a voltage below the impulse sparkover. When lightning strikes, this *pre-ionizes* the gap. As the surge builds up——BANG!—the Westinghouse SV arrester *always* sparks over at the designed value.

YOU CAN BE **SURE**... IF IT'S

Westinghouse

Approved by UNDERWRITERS LABORATORIES

YES, the PENN-UNION Connector TAKES THEM ALL-

LARGER SURFACES for the WRENCHES ~ a good-sized HEX Top and Bottom

The men who use connectors appreciate the *better design* of the Penn-Union - - especially when they have to make a splice in close quarters, or any unhandy location.

Better Design is a feature of the entire Penn-Union line, which includes Tees and Taps, Straight Connectors, Terminals, Grounding Clamps, and many more fittings . . . every one thoroughly dependable, mechanically and electrically. *Preferred by leading users,* who have found that "Penn-Union" on a fitting is their best guarantee of unfailing service.

Far More in use than any other

Sold by Leading Wholesalers

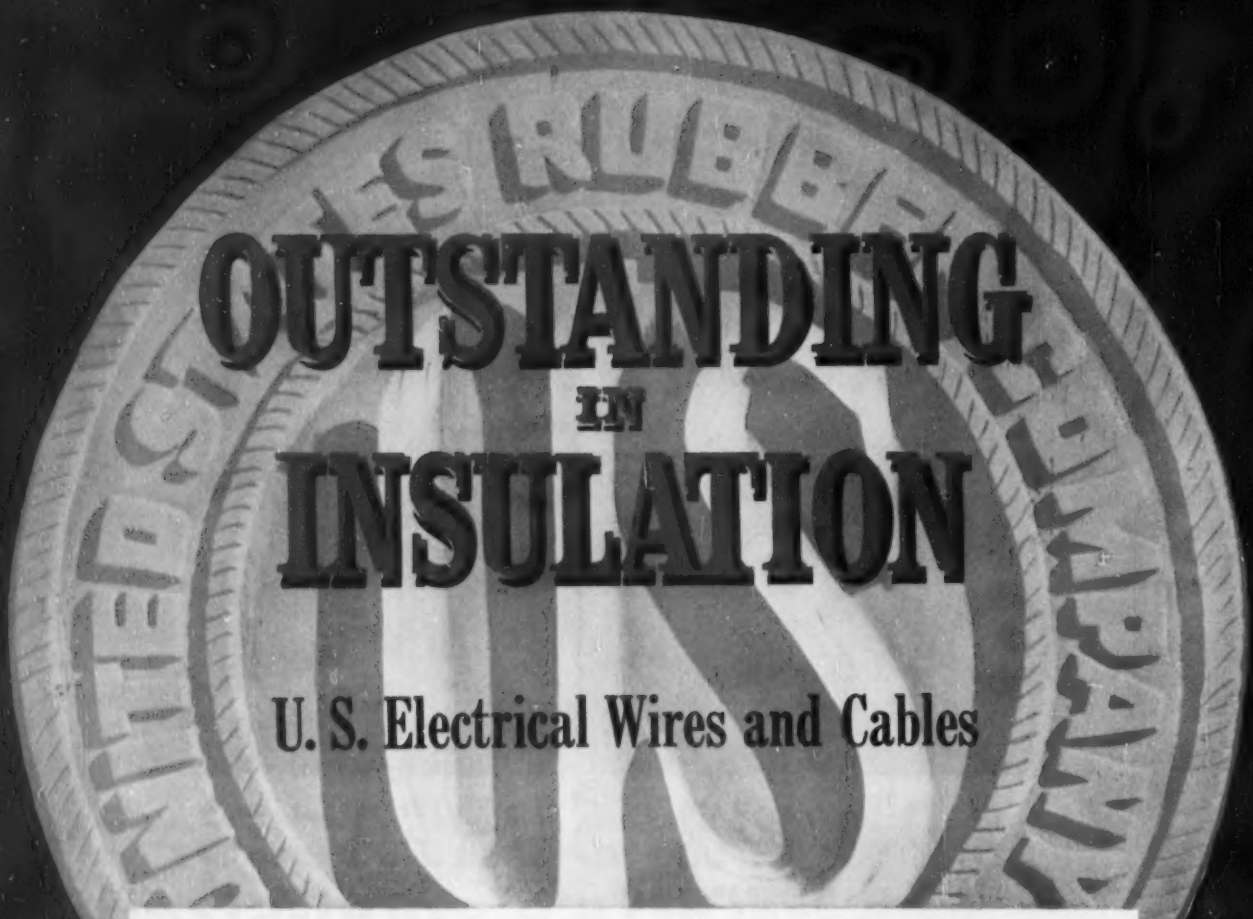
PENN-UNION ELECTRIC CORPORATION, Erie, Pa.

Canada: Dominion Cutout Company, Ltd., 250 Richmond St. West, Toronto

The Complete Line of Conductor Fittings

PENN-UNION

UNITED STATES RUBBER COMPANY



OUTSTANDING IN INSULATION

U. S. Electrical Wires and Cables

LAYTEX® RUH-RUW—The world's smallest diameter, lightest weight natural rubber-covered power and lighting wire.

NEOLAY® RU—With Laytex Insulation plus Neoprene. Nylon cover makes pulling five times easier.

CONTROL CABLE—Insulated with Laytex for greater circuit integrity.

NEOPRENE COVERED SERVICE ENTRANCE CABLE—Flame retardant, moisture resistant—the first ever accepted by Underwriters' Laboratories, Inc.

MUNICIPAL SIGNAL CABLES—Insulated with Laytex for maximum moisture resistance.

POWER CABLES—Of every description, including the famous Grizzly® line of tough cables.

ALUMINUM WIRES AND CABLES—U. S. Rubber introduced insulated aluminum conductors.

ELECTRIX® PLUGS—U. S. Rubber was a pioneer in the development of soft rubber plugs for extension cord sets and power supply cords. (Also all rubber cube taps.)

ROYAL PORTABLE CORDS AND CABLES—And many other types of electrical wires and cables.

ROYAL MINING MACHINE & LOCOMOTIVE CABLES—Tested many different ways to insure complete dependability.

INTERCOMMUNICATION CABLE—With thermoplastic insulation and jacket making this cable flameproof throughout.

TWISTED SERVICE DROP CABLE—Either neoprene insulated or performance insulation and neoprene jacket; copper or aluminum conductors.

UNITED STATES RUBBER COMPANY · ELECTRICAL WIRE & CABLE DEPARTMENT

1230 Avenue of the Americas · Rockefeller Center, New York 20, N. Y.

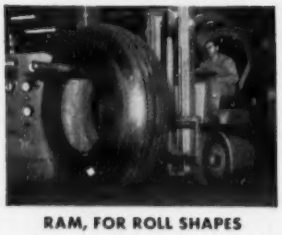
IS YOUR JOB HARD TO HANDLE?

LOOK AT WHAT ONE HYSTER JOB-ATTACHMENT CAN DO

REVOLVING LOAD-GRAB

SCOOP, FOR LOOSE MATERIALS

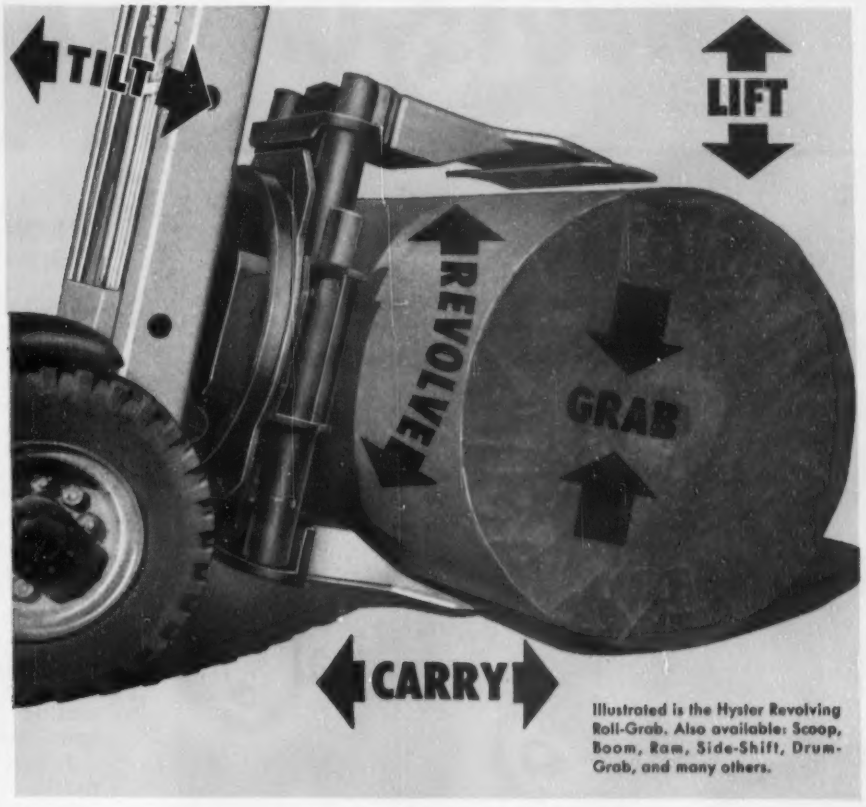
PULPWOOD BOOM



RAM, FOR ROLL SHAPES

LOAD-GRAB FOR CRATES, BOXES

BOOM, AS MOBILE CRANE



Illustrated is the Hyster Revolving Roll-Grab. Also available: Scoop, Boom, Ram, Side-Shift, Drum-Grab, and many others.

...over 100 HYSTER® JOB-ATTACHMENTS offer NEW WAYS to save money by better materials handling

"You can handle just about *anything* with a Hyster Lift Truck and the right job-attachment," say experienced operators. Hyster records, covering practically every industry, bear this out. They show that the right Job-Attachment greatly speeds handling, often makes possible greater use of lift trucks...thus realizing more of the basic advantages of lift truck operation. In many cases, Hyster Job-Attachments eliminate need for pallets, *saving even more money!*

The Load-Grab® is only *one* of many basic lift truck Job-Attachments developed and pioneered by Hyster. However you are now handling your materials at receiving, in-process, storage, or shipping — inside or outside — the proper Hyster Job-Attachment can reduce your handling costs *still further!* Your Hyster Dealer will be glad to show you how. Every one should have Hyster Attachments Catalogs 1266 and 1219. Write:

HYSTER COMPANY

2947 N. E. Clackamas.....Portland 8, Oregon
1047 Myers Street.....Danville, Illinois

"Every Hyster Dealer is a Lift Truck Service Station"

THERE'S PROFIT IN HYSTER POWER

HYSTER COMPANY • FOUR FACTORIES: PORTLAND, OREGON • DANVILLE, ILLINOIS • PEORIA, ILLINOIS • NIJMEGEN, THE NETHERLANDS

Allis-Chalmers

NETWORK Meets Growing Load

UNION ELECTRIC COMPANY faced both load and space problems in downtown St. Louis. Increasing loads required an addition to the company's network system. Heavy congestion made space hard to find.

So when space was located, the company planned wisely for future growth as well as for the present problem. The new vault was made double size. Holding a 500-kva Allis-Chalmers network transformer now, it leaves room for one more when future growth demands.

Careful attention to details during design and construction makes A-C transformers especially suited for this type of installation. Accessories are conveniently located. Protective coating against corrosion is applied to surfaces and tubes in the base area. Best possible sealing for bushings is provided by spiral wound metallic gaskets.

It will pay you to investigate all these details — as well as the compact low-loss design and high thermal capacity that help A-C network transformers meet severest load conditions. Get more facts from your nearby A-C district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4186

UNION ELECTRIC'S installation foreman, J. Edward Slocksick, checks nameplate information before new network transformer is installed near corner of Eighth and Pine Streets in the heart of St. Louis.

AREA SERVED includes one of the largest office buildings in St. Louis, the Arcade Building, where St. Louis Cardinals and many other amusement enterprises maintain offices. Building also contains many popular commercial shops. Left: crane picks transformer off truck.

ALLIS-

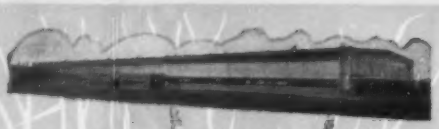
TRANSFORMER

in Downtown St. Louis

NETWORK TRANSFORMER was lowered into an entirely new vault, constructed double size to leave room for future system growth. Allis-Chalmers network transformers have been serving Union Electric for ten years. More than 1¼ million kva of these units are in operation throughout the country. Dependability — proved by outstanding service records — shows why Allis-Chalmers network transformers are ideally suited to crowded locations like this where service continuity is all-important.

CHALMERS

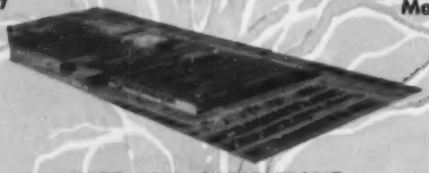
A-C ALLIS-CHALMERS



BRASS AND COPPER TUBE MILL
New Brunswick, New Jersey

PLASTIC PIPE PLANT
New Brunswick, New Jersey

CONDUIT PLANT
Moundsville, West Virginia



WIRE AND CABLE PLANT
New Brunswick, New Jersey

In 1916, we manufactured two products in a little Brooklyn plant. Today, we operate four large factories making a huge variety of products.

How Does A Company Grow?

A company grows not alone because of the quality of its products. We, at Triangle, are well aware that success depends on something more. Success depends on our attitude towards people — customers and prospects — people like you.

That's why, at Triangle, you get, *in addition to* top quality products —

THE HUMAN TOUCH

FRIENDSHIP **LOYALTY**
HONESTY **EXTRAORDINARY SERVICE**

Those are our roots. Those are the reasons why we grew.

TRIANGLE CONDUIT & CABLE CO., INC.

New Brunswick, New Jersey

Manufacturers of arteries for electricity, liquids and gases

WIRE • CABLE • CONDUIT • PLASTIC PIPE • BRASS AND COPPER TUBE

PLANTS: NEW BRUNSWICK, NEW JERSEY

WIRE AND CABLE PLANT • ROD MILL • BRASS AND COPPER TUBE MILL
PLASTIC PIPE PLANT

MOUNDSVILLE, WEST VIRGINIA: CONDUIT PLANT

The Trade Mark of TOP Quality

TRIANGLE

IT MUST BE RIGHT!

R&IE SUBSTATION STRUCTURES

from Design to Delivery

1. R&IE Substation Service is controlled and centralized at one source. One responsibility, under "one roof" for design, fabrication and application of Switching Equipment.
2. R&IE "know-how", verified by over forty years of dependable construction experience, produces a correct installation, mechanically and electrically.
3. The installation shown below required all-aluminum structural members, bolts and nuts. Fabrication and erection time can be greatly reduced with this kind of metal, and maintenance reduced to an absolute minimum.

R&IE SUBSTATION EQUIPMENT
DIVISION OF I-T-E CIRCUIT BREAKER CO.
GREENSBURG, PA.

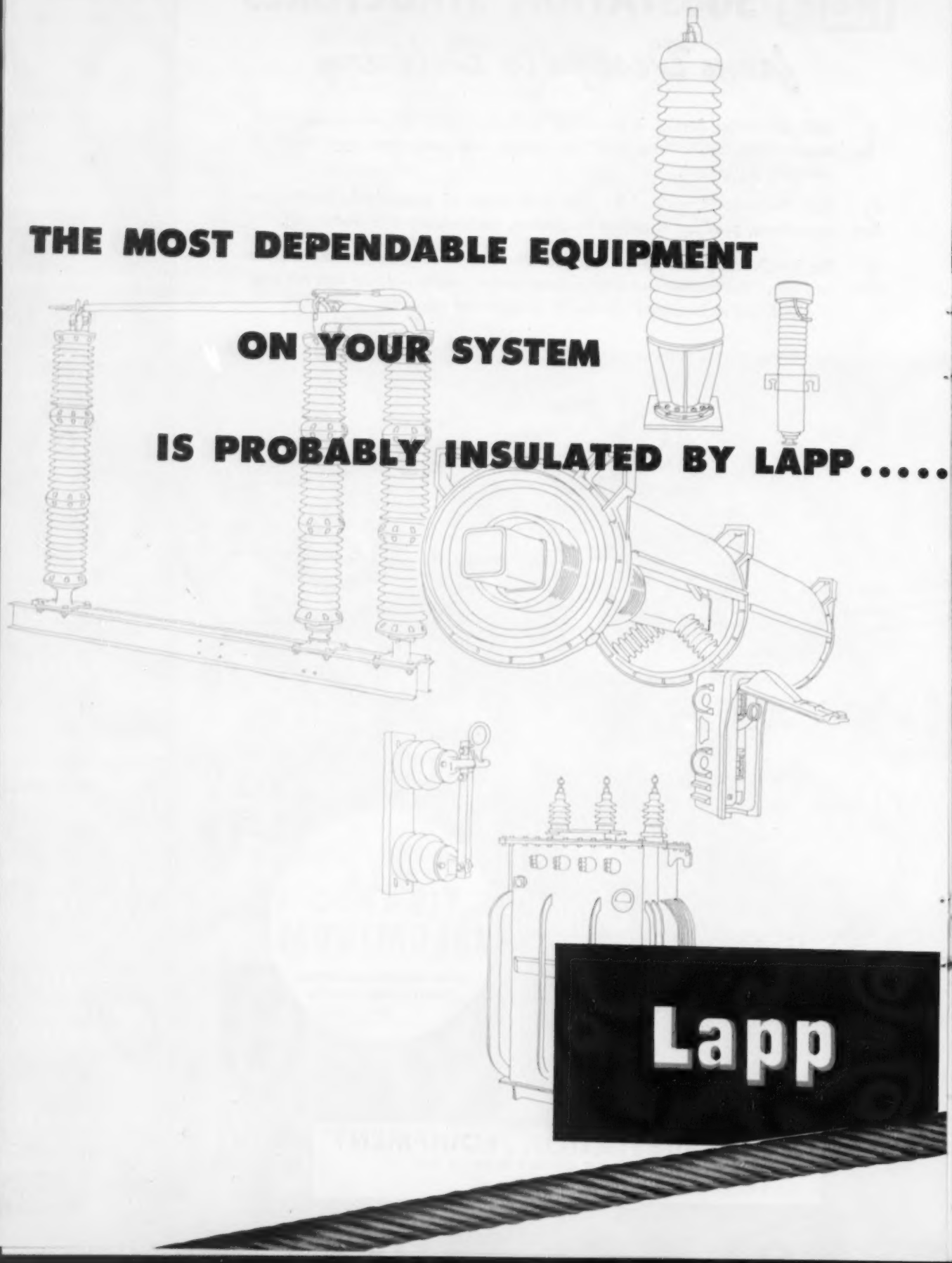
The Check List

- CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- HORN GAP SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- DISTRIBUTION EQUIPMENT
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES
- KIRK INTERLOCK SYSTEMS
- AUTOMATIC SWITCHING EQUIPMENT
- METAL CUBICLES
- TESTING DEVICES

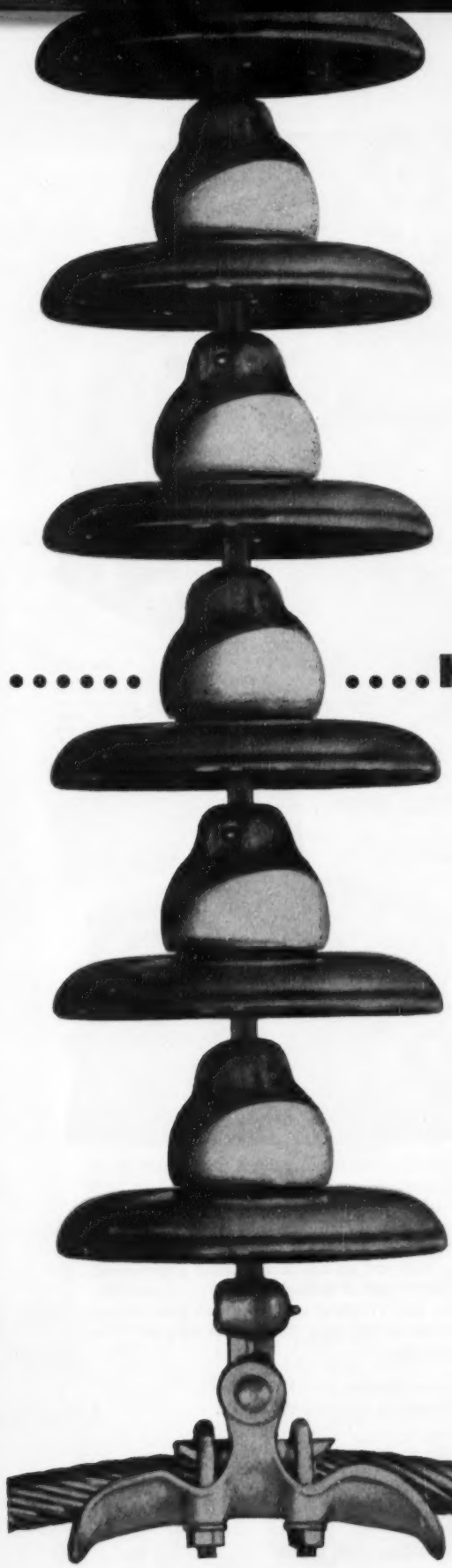
THE MOST DEPENDABLE EQUIPMENT

ON YOUR SYSTEM

IS PROBABLY INSULATED BY LAPP.....



Lapp



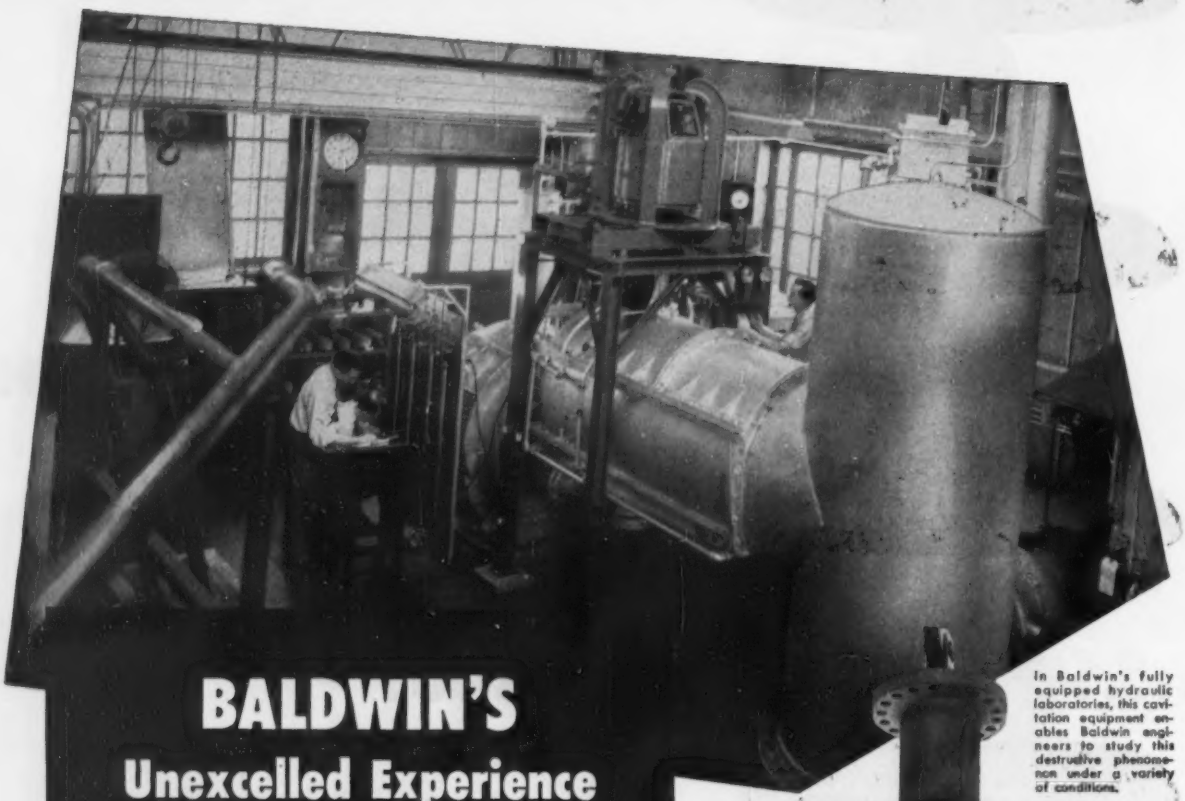
....HOW ABOUT YOUR TRANSMISSION LINES?

Manufacturers of the best in switches, transformers, lightning arresters, fuse boxes, and other high-voltage electrical equipment look to Lapp for insulators and "special porcelain" insulating components. That's because they know porcelain-and-metal assemblies produced by Lapp offer an extra margin of operating security . . . long life . . . and low upkeep. Lapp porcelain adds value, because it adds dependability, to such equipment.

The porcelain-and-metal assembly of which Lapp has made more units than any other, is the 10" suspension disc. This "simple design" has had more research and testing than anything else we have ever worked on.

We know, as do hundreds of power companies, that there's no surer way to build security and long service into a transmission line than to hang it on Lapp suspension insulators.

Lapp Insulator Co., Inc., Le Roy, N. Y.



In Baldwin's fully equipped hydraulic laboratories, this cavitation equipment enables Baldwin engineers to study this destructive phenomenon under a variety of conditions.

BALDWIN'S Unexcelled Experience and Research Pay Off Again With 94% Efficiency of Center Hill Turbines

Here is the one-piece, 127,200 lb., 186⅝ in. runner for the Baldwin 62,500 hp Francis-type turbine at Center Hill and Wolf Creek Dams.

Baldwin's continuing research, combined with experience in designing and building all types of turbines from as early as 1825, is paying a big dividend to the Corps of Engineers at its Center Hill and Wolf Creek Dams.

Initial tests of one of three 62,500 hp vertical Francis-type turbines at Center Hill showed a maximum attained efficiency (at 105.9 rpm and 160 foot head) of 94% . . . one of the best efficiency records ever obtained for Francis-type units. Since the six Baldwin-built turbines for Wolf Creek are identical, the Corps of Engineers has the benefit of similar high efficiency for its two Cumberland River Valley hydro-electric plants which will generate about 1218 million kwhr each year.

Whatever your hydro-electric project, Baldwin engineers will be glad to put their vast experience and resources at your service to help you get top performance. Experienced with all four basic type of turbines . . . Francis, Kaplan, Pelton Impulse and Propeller . . . they can give you an unbiased opinion of the type best suited to your flow and head conditions.

For details about Baldwin research and some interesting turbine installations, please write for Bulletin 1000 to Department 5107, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pa.

BALDWIN BLH LIMA-HAMILTON

BALDWIN-LIMA-HAMILTON

Philadelphia 42, Pa. • Offices in Principal Cities

INSTALL WIREWAYS FASTER!

SQUARE D's NEW AND EXCLUSIVE *Lay-in Duct*

FASTER ASSEMBLY!
LESS NUTS AND BOLTS
FASTER WIRING!
NO MORE THREADING OR PULLING OF CONDUCTORS...JUST LAY THEM IN
FASTER HANGING!
UNIVERSAL TYPE HANGERS
FASTER GANGING!
KNOCKOUTS MATCH THOSE ON RELATED SQUARE D EQUIPMENT. NO CONDUIT BENDING

Square D's exclusive design provides hinged covers for both the duct sections and connectors. Easily removable fitting covers then provide a completely unobstructed wireway in which to lay wires.

LAY-IN DUCT is available in 2½" x 2½", 4" x 4", and 6" x 6" sizes, in standard lengths of 1, 2, and 5 feet. There is a complete line of fittings, all with the "lay-in" design feature.

• • •

Write for the complete story of **LAY-IN DUCT**—how it gives you a better wireway system, easier, faster and at less cost. Address Square D Company, 6060 Rivard Street, Detroit 11, Michigan.

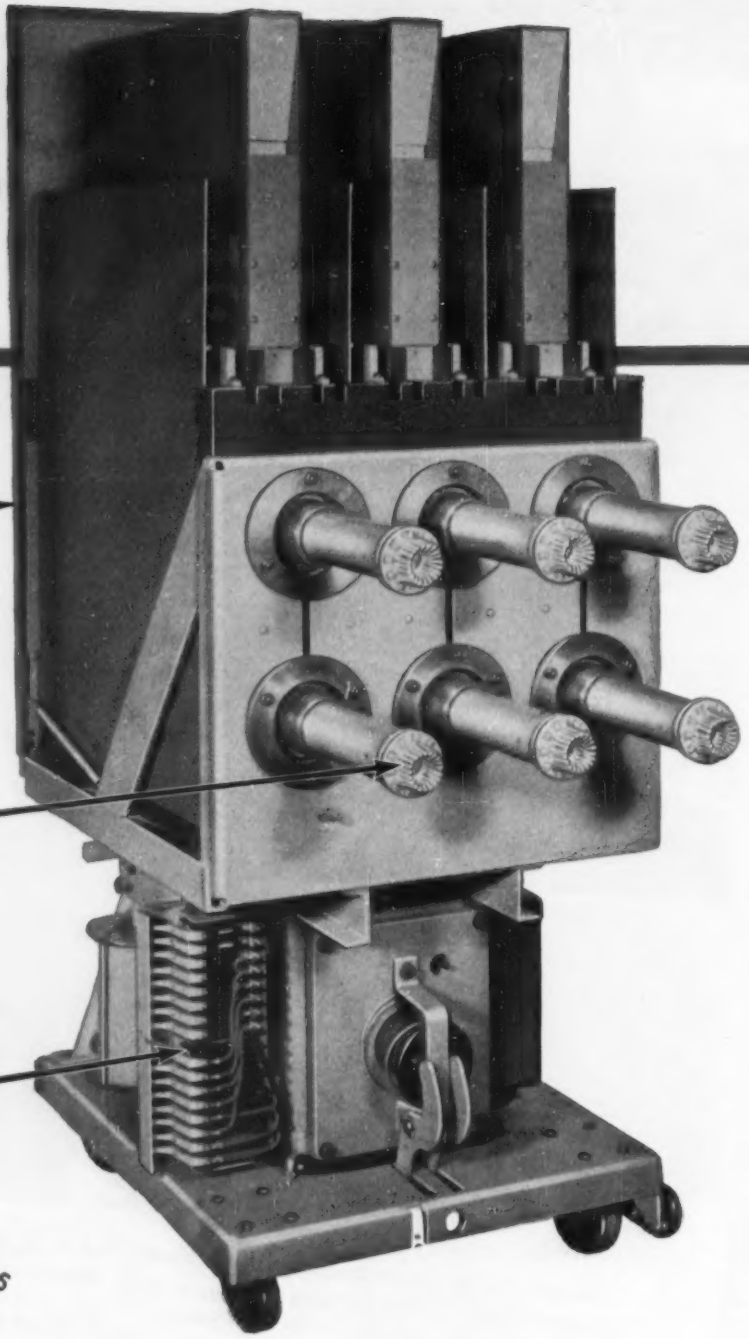
ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

ALLIS-CHALMERS

PROGRESS IN

Switchgear



Safety first! Steel panel in front completely seals off high voltage members

Primary contact fingers are on bushing of movable portion ... easy, safe to inspect

Secondary disconnects are direct-connected to auxiliary switches- eliminating wiring

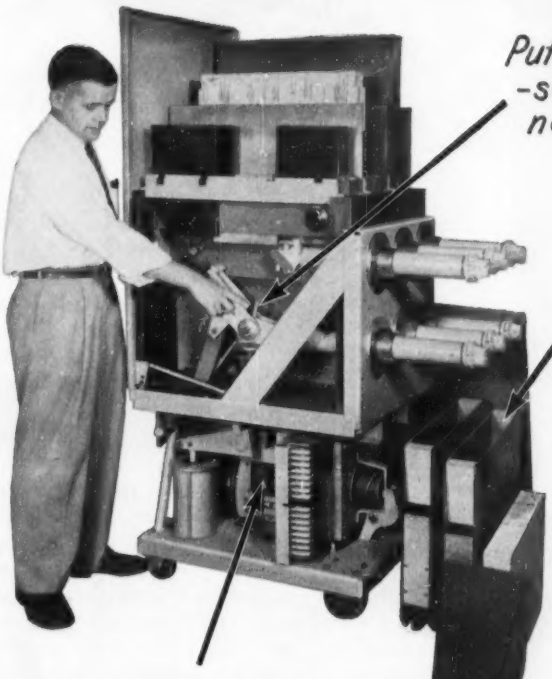
Shorter interrupting times for low currents

For additional information on this outstanding new breaker, call your nearby A-C district office or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4175

ALLIS-

engineering notes on

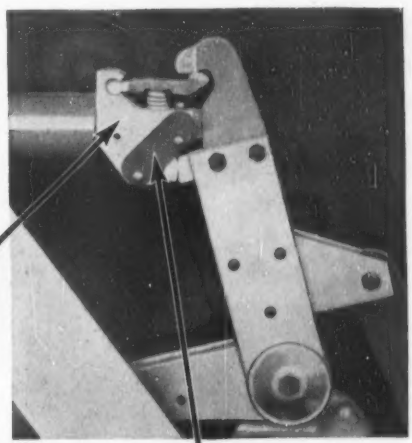
New 13.8-Kv Breaker



Puffer at ground potential -separately mounted- not on moving part

Each part of arc chute assembly is separately movable and can be conveniently handled by one man

Only 3 parts of operator plus armature move on closing operation; latch and trip-free link plus 3 parts of operator move during opening



Contacts are blow-on type. Magnetic field is arranged so that contact pressure increases as current increases

Access to contacts may be made by removing this insulated cover

CHALMERS

A-C ALLIS-CHALMERS

$ensible $aving

is the smart reason for the 20 ft. length of these rolls. You get this size in the 10-roll container of *Gold Seal* Plastic Tape. For companies that supply tape to many workers for varied jobs, it's the best buy. "Tape-saver" size, we call it. It's enough for the average job . . . footage of "lost" tape is kept low. Workers like the small size, too. It "swings" easy in tight places. And remember, you start saving the minute you say

GOLD SEAL
plastic tape

It gives you the many plastic tape advantages, with the plus of proved Gold Seal quality. With the warranty of Jenkins Tape specialists, you can be sure it will speed the job, stick right, and stand up under toughest conditions. Try it . . . sample free on request. Jenkins Bros., Rubber Division, 100 Park Ave., New York 17.

Gold Seal Plastic Tape — single 60 ft. rolls in round metal cans and Handy Pack of ten 20 ft. rolls.

JENKINS

Gold Seal Tape

FRICTION • RUBBER • PLASTIC

Single rolls and 10-roll containers. Also Diamond Seal Friction and Rubber Tapes made to ASTM Specifications. Products of Jenkins Bros. — makers of famous Jenkins Valves.

Here's Proof of Performance...

3 out of 4 pressure-creosoted poles in this line are still standing *after 38 years*

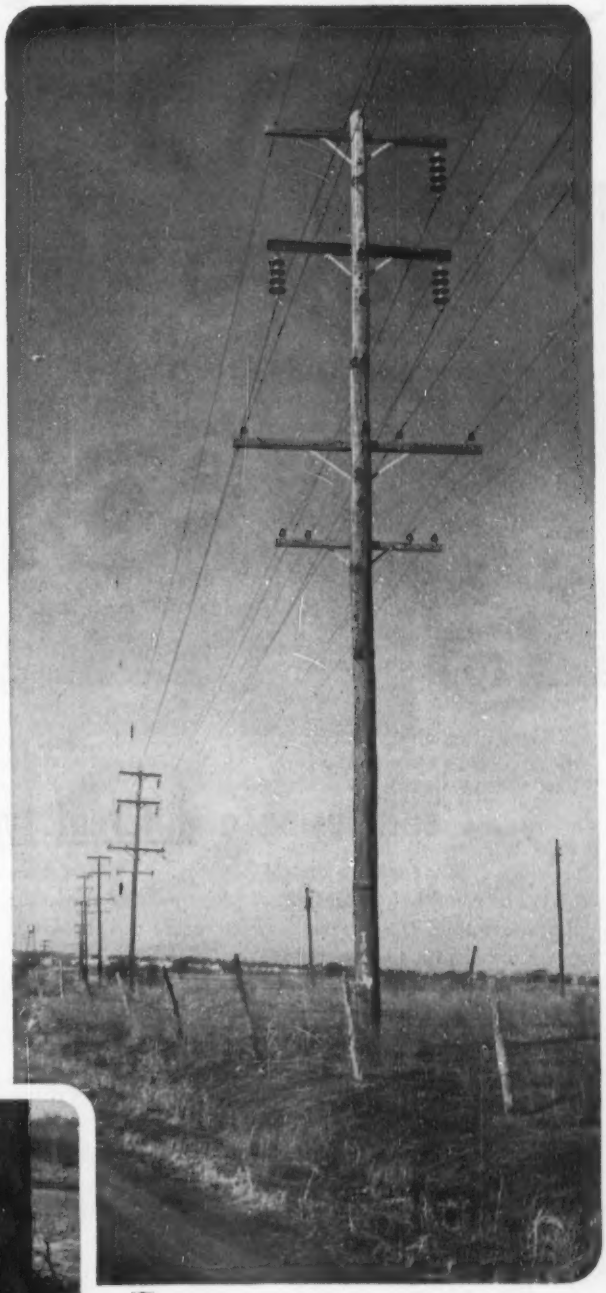
● More than 40 years ago, Texas Power & Light Company turned to the use of pressure-creosoted poles to counteract the effect of weather and decay. It was a wise choice and officials of the utility say today: "We have saved many thousands of dollars over the years through our use of creosoted poles."

A good example of the service life of pressure-creosoted poles is the Company's line between the Jenkins substation in Dallas County, and Royse City. Here 475 creosoted Southern Yellow Pine poles were installed in 1916. Today, three of every four of these original poles are still standing in spite of the temperature extremes and biting winds encountered in this area.

When you compare this kind of a service record with the 10 to 20 years of life Texas Power & Light was getting from untreated poles, you have real proof of the effectiveness of Creosote's protection.

Be sure your poles are pressure-treated for extra life with U·S·S Creosote. This wood preservative is the product of continuous processing in the plants of United States Steel. As such, it is a uniform product, made to give you uniformly good results. For complete information, contact our nearest Coal Chemical sales office or write directly to United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

Close-up of one of the 38-year-old poles at the ground line, showing the excellent condition of the treated wood.



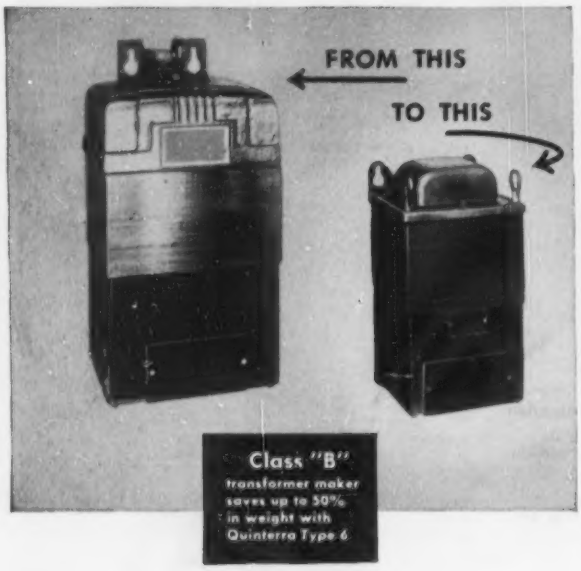
Pressure-creosoted poles in the Jenkins-Royse City line of Texas Power & Light Company. 475 poles were installed in 1916—75% of the original poles are still in service.

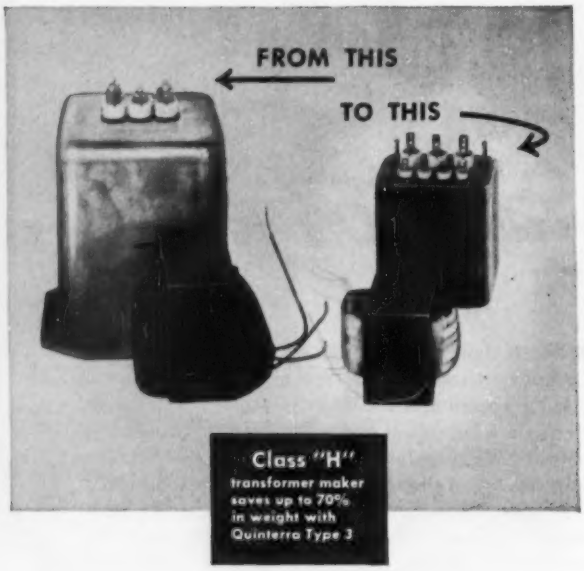
U·S·S CREOSOTE

4-251

UNITED STATES STEEL

Quinterra BRINGS SUBSTANTIAL SAVINGS to Class "B" and Class "H" transformer makers...





. . . each using a different type Quinterra® to meet his needs

THE two "before and after" photographs above do more than show what manufacturers can do when they employ Quinterra as layer insulation. They also demonstrate that the manufacturer is not limited to one type of this thin, flexible, purified asbestos insulation. Any one of several types will help him conserve materials, gain greater safety, raise overload limits, decrease rejects, lessen production costs, and lengthen service life.

For Class "B" operations, he can choose Type 6 . . . the twin-ply Quinterra treated with polyvinyl acetate. It retains its dielectric strength of about 300 VPM at temperatures above the Class "B" maximum of 130 C. Strongest of the Quinterras, it is made by combining and calendering two layers together into a dense, smooth-surfaced sheet. Its excellent tensile and bursting strengths enable assemblers to reach favorable production rates. And it also provides a large square foot per dollar coverage*.

For Class "H" operations or for high processing and ambient temperatures, the manufacturer can choose single-ply silicone-treated Quinterra Type 3. Its dielectric strength of about 300 VPM is retained under continuous exposure to temperatures higher than 180 C, the Class "H" maximum. It also has good moisture-resistance, flexibility, and adequate physical strength for many applications.

Each of these Quinterras is made of the same highly purified asbestos base sheet that has the inherent dielectric . . . and has a hole-free, closed structure. They differ only in the saturant used and in the number of plies. For further information and samples of Quinterra, write to Johns-Manville, Box 60, New York 16, N. Y. No cost or obligation.

*Also true of its companion product, Quinterra Type 5, which is preferable for applications where maximum mechanical strength is not required.

JOHNS MANVILLE JM PRODUCTS

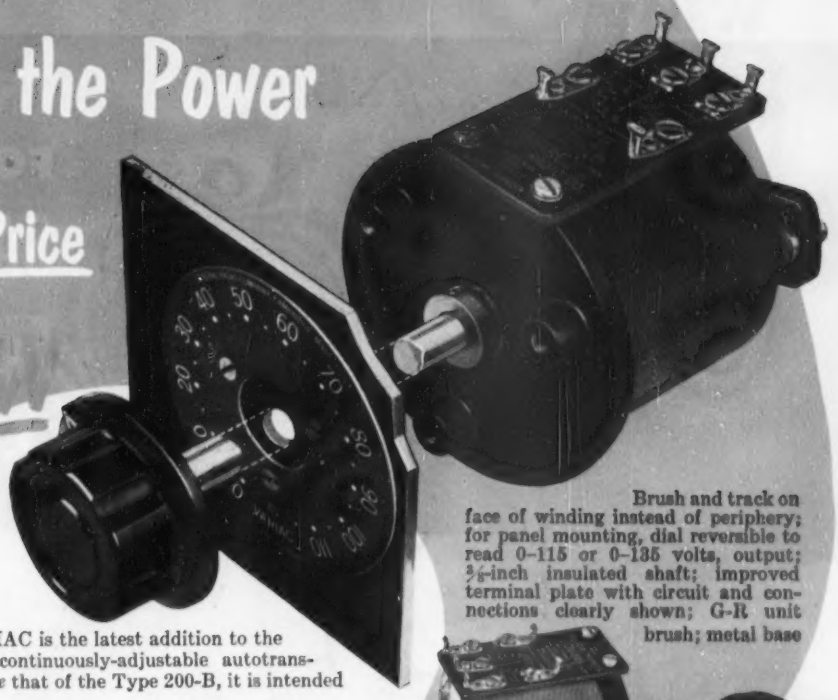
Johns-Manville ELECTRICAL INSULATIONS

Twice the Power

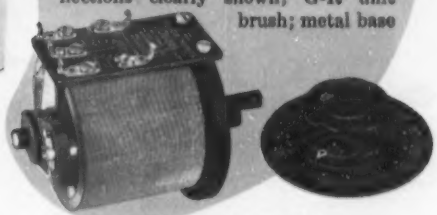
for the Same Price

with the NEW

type V-2 Variac



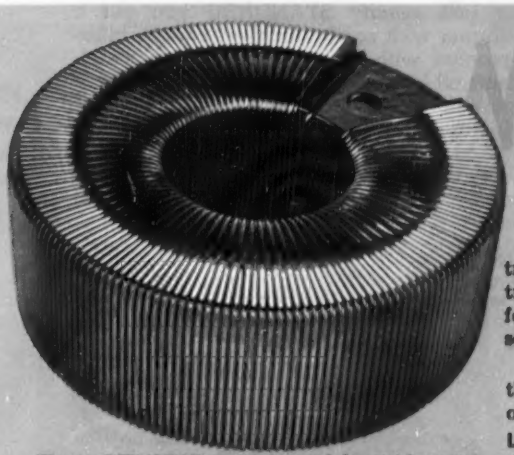
Brush and track on face of winding instead of periphery; for panel mounting, dial reversible to read 0–115 or 0–135 volts, output; ¼-inch insulated shaft; improved terminal plate with circuit and connections clearly shown; G-R unit brush; metal base



The *new* Type V-2 VARIAC is the latest addition to the popular "V" series of VARIAC continuously-adjustable autotransformers. With a power rating of *twice* that of the Type 200-B, it is intended eventually to supplant the latter.

The Type V-2 represents a considerable improvement over the 200-B, making it even more adaptable to a wide variety of applications where a relatively low-power, moderately-priced, a-c voltage control with all of the latest exclusive VARIAC features is needed. Its electrical and mechanical features include:

- New DURATRAK brush-track coating
- Load rating of 0.345 kva (instead of 0.17 kva)
- Output voltages continuously adjustable from 0 to 135 v, or 0 to 115 v.
- Line frequency 50 to 60 cycles; no load loss at 60 c.: less than 3.5 watts
- ★ Standard mounting holes (interchangeable with Type 200-B)
- ★ Considerably less panel space
- ★ Metal Base for improved cooling and added strength
- ★ More rugged stops
- ★ G-R Unit Brush construction
- ★ Terminal board with circuit and connections clearly shown
- ★ Molded knob-pointer and reversible dial plate for panel installation
- ★ Meets applicable requirements of Military Specification for Transformers: MIL-T-27
- ★ **Moderate Price: $12.50**



The new DURATRAK coating is one of the most important improvements in VARIACS; another step in the continuing process of development which makes the VARIAC the best voltage control available

NOW

ALL "V" TYPE VARIACS HAVE *NEW* Duratrak CONSTRUCTION

for Increased Performance Even Longer Life

The new DURATRAK brush-track coating eliminates all brush track oxidization problems which formerly might become critical under severe conditions of operation.

DURATRAK construction adds these features to increase the utility of VARIACS:

Long Life — *insures a life as long as that of fixed-ratio power transformers operated at rated loads*

Unaffected By Surges — *VARIACS with DURATRAK will withstand initial surges as high as ten times rated current*

Minimum Maintenance — *the brush track will not deteriorate under normal operation — only maintenance needed is occasional wiping of track with alcohol-moistened rag*

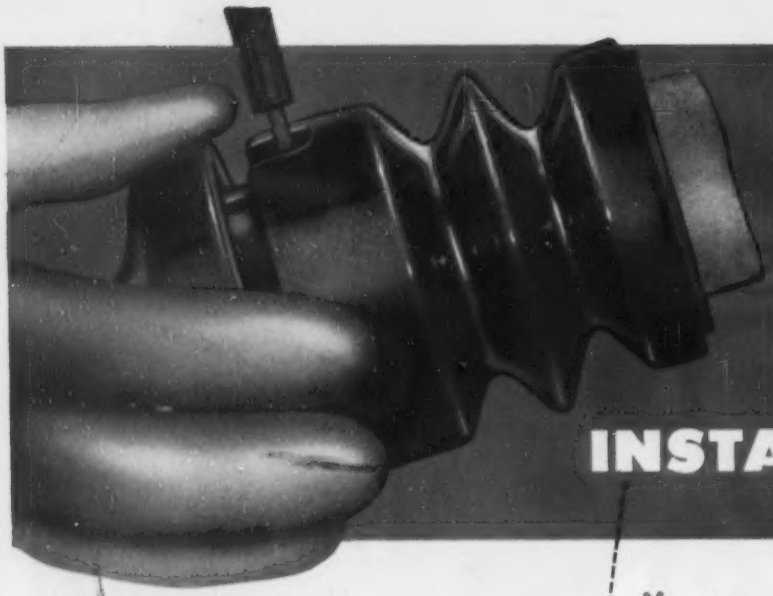
Write for the NEW VARIAC BULLETIN for Complete Specifications

GENERAL RADIO Company

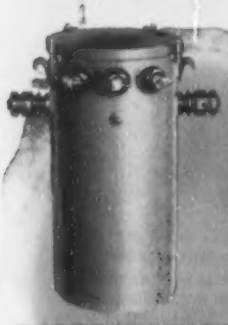
275 Massachusetts Avenue, Cambridge 39, Massachusetts, U. S. A.

90 West St. NEW YORK 6 · 920 S. Michigan Ave. CHICAGO 5 · 1000 N. Seward St. LOS ANGELES 38

Admittance Meters ☆ Coaxial Elements ☆ Decade Capacitors
Decade Inductors ☆ Decade Resistors ☆ Distortion Meters
Frequency Meters ☆ Frequency Standards ☆ Geiger Counters
Impedance Bridges ☆ Modulation Meters ☆ Oscillators
Variacs ☆ Light Meters ☆ Megohmmeters ☆ Motor Controls
Noise Meters ☆ Null Detectors ☆ Precision Capacitors
Pulse Generators ☆ Signal Generators ☆ Vibration Meters ☆ Stroboscopes ☆ Wave Filters
U-H-F Measuring Equipment ☆ V-T Voltmeters ☆ Wave Analyzers ☆ Polariscopes



FOR SAFE, EASY, FAST INSTALLATIONS



Type A, OISC conventional distribution transformer, 15 KVA, single-phase, 60-cycle, with side wall mounted high voltage bushings. Standard construction for voltages 5 KV and less, and sizes through 100 KVA.

DISTRIBUTION TRANSFORMERS

Type CSP, OISC distribution transformer, 15 KVA, single-phase, 60-cycle, with primary lightning arresters, internal fuses, low voltage circuit breaker and side wall mounted high voltage bushings. Standard construction for voltages 5 KV and less and sizes through 100 KVA.

You make primary line connections the new, improved way on STANDARD'S 2400 or 4800 volt Distribution Transformers. Working closely with operating men in the field, The Standard Transformer Company developed time-saving Tank Wall Bushings which permit flick-of-the-wrist installations . . . without tools. No "live parts" exposed . . . terminal compression stud keeps easy-to-grip, insulated porcelain cap from falling off when unscrewed to receive primary lines. Cable can be brought in from either side and held securely by pressure from clamping shoe.

Perfected side mounted bushings, plus additional sound basic construction features, make STANDARD'S 2400 or 4800 volt Transformer one of the best buys on the market today. When you specify STANDARD you get a transformer with easily-removed covers, moisture-proofed with a Neoprene gasket which prevents oil leakage; a low-loss core assembly housed in a rugged, all-weather, copper-bearing steel tank; a core assembly made of non-aging, varnish-coated, silicon steel sheets. These features mean a long-lived, trouble-free transformer . . . silently, efficiently working for you.

Write for specific information on new Tank Wall Bushings.

Everything Points To...

Standard

THE STANDARD TRANSFORMER COMPANY

Trade Mark ®

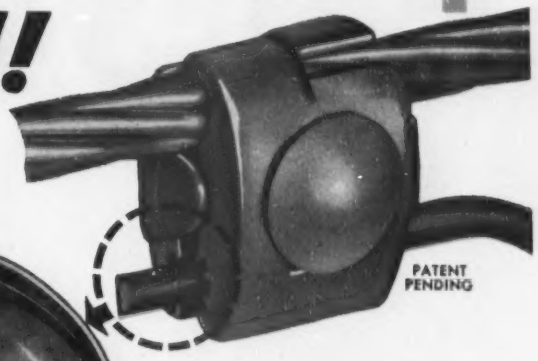
WARREN, OHIO

REPRESENTATIVES IN PRINCIPAL CITIES

WRITE FOR BULLETIN CL-50

Tells the story with words and pictures of STANDARD'S complete line of transformers, and how they perform for every class of service . . . on the job.

REVOLUTIONARY NEW DESIGN of ALUM-COPPER Parallel Groove Clamp! by BLACKBURN!



NEWLY DEVELOPED PROCESS... eliminates use of solder in attaching copper liner to cast aluminum body — no moisture trapping voids or corrosive fluxes between liner and body to foster galvanic corrosion.

COPPER LINER PERMANENTLY LOCKED IN – SEALS OUT MOISTURE!

Aluminum body is pressure cast around the pronged copper liner. Because the aluminum body has a greater coefficient of contraction than the pronged copper liner, it exerts great clamping forces against the prongs as the molten aluminum solidifies. This air-tight shrink-fit permanently seals out moisture.

Operating temperatures under the most severe conditions never approach the heat of the aluminum in its molten state, therefore high clamping forces against the pronged liner are retained . . . liner cannot come loose.

HIGH CONDUCTIVITY

Special surface treatment of the under side of the copper liner reduces surface tension of the molten aluminum. This establishes an intimate low-resistant contact between the two metals.

STRONG – CORROSION RESISTANT

Aluminum bodies are cast of a special alloy, selected for its high corrosion resistance. This alloy is exceptional in that it also combines high strength with ductility. Steel bolt, nut and lock washer are hot dipped galvanized.

SIMPLIFIES STOCKING PROBLEMS

One clamp covers a wide range of popular conductor sizes.

ORDERING INFORMATION

	Copper	Aluminum
PAC 6/0	8 AWG to 2 stranded	6 ACSR to 1/0 ACSR

Mail Coupon Below for FREE Sample — or — Order TODAY!

JASPER BLACKBURN CORPORATION
35 Madison St. — St. Louis 6, Mo.
Phone CEntral 3007

BLACKBURN *Parallel Groove* **CLAMPS**

FREE SAMPLE-MAIL TODAY

JASPER BLACKBURN CORPORATION
35 Madison St., St. Louis 6, Mo.

Send FREE Sample of New ALUM-COPPER Parallel Groove Clamp.

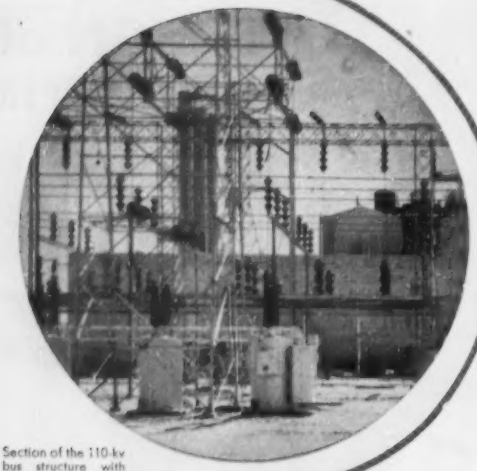
Your Name and Title.....

Firm.....

Address.....

City and State.....

Exide-Manchex
BATTERIES



Section of the 110-kv bus structure with main turbine building in background.

USED BY P.G.&E.

At this great Moss Landing plant of the Pacific Gas and Electric Company, five huge turbo-generators, with a rated capacity of 575,000 K.W., are now in operation. During 1953 this capacity will be doubled, making it one of the nation's largest producers of electric power. Through the company's vast interconnected system, power from this station can be transmitted to other areas as needed.

All control power for operation of circuit breakers and for carrying the emergency lighting load, is supplied by Exide-Manchex, the dependable battery which assures:

POSITIVE OPERATION: Dependable performance at ample voltage with no switchgear failures.

INSTANTANEOUS POWER: High rates for switchgear operation with adequate reserve power for all other control circuits and for emergency lighting.

LOW OPERATING COST: Extremely low internal resistance.

LOW MAINTENANCE COSTS: Water required about twice a year. No change of chemical solution during life of battery.

LOW DEPRECIATION: Sturdy, long-life construction.

GREATER CAPACITY in a given amount of space avoids overcrowding.

• • •

Various sizes and types of Exide Batteries are available in plastic containers.

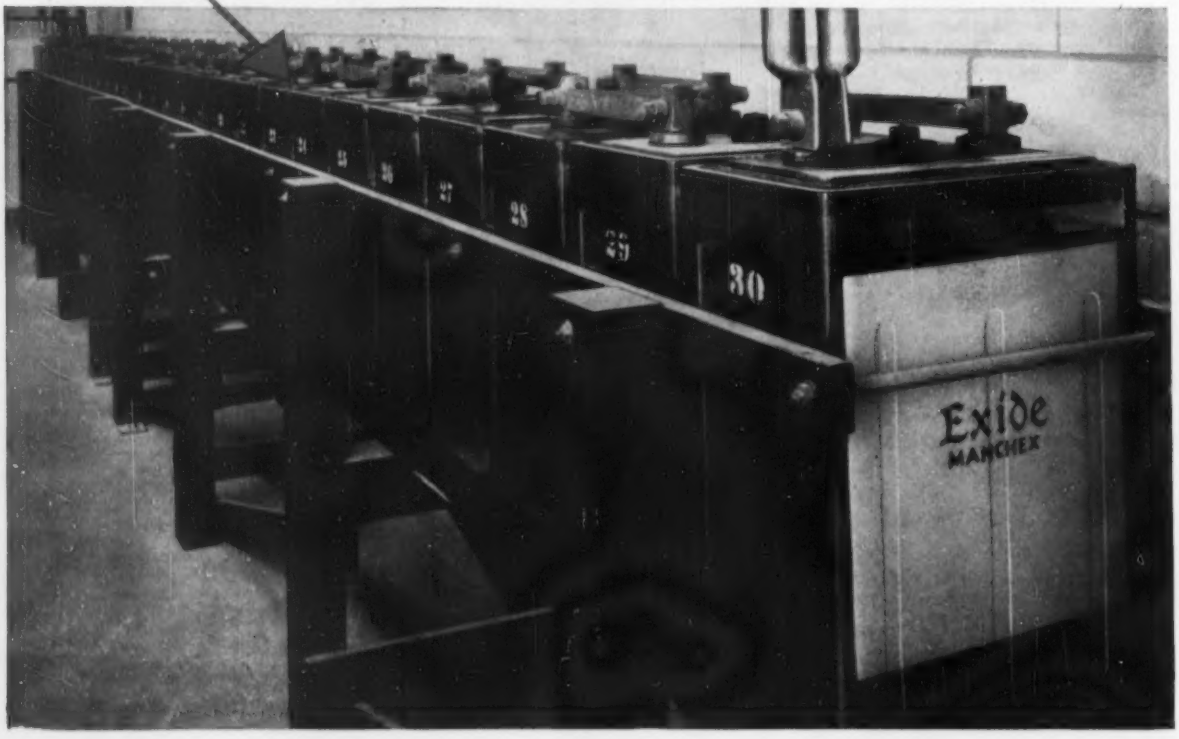
Exide-Manchex is your best battery buy for all control and substation services.

Moss Landing Steam Plant of Pacific Gas & Electric Company. Stone & Webster Engineering Corporation, engineers and builders.

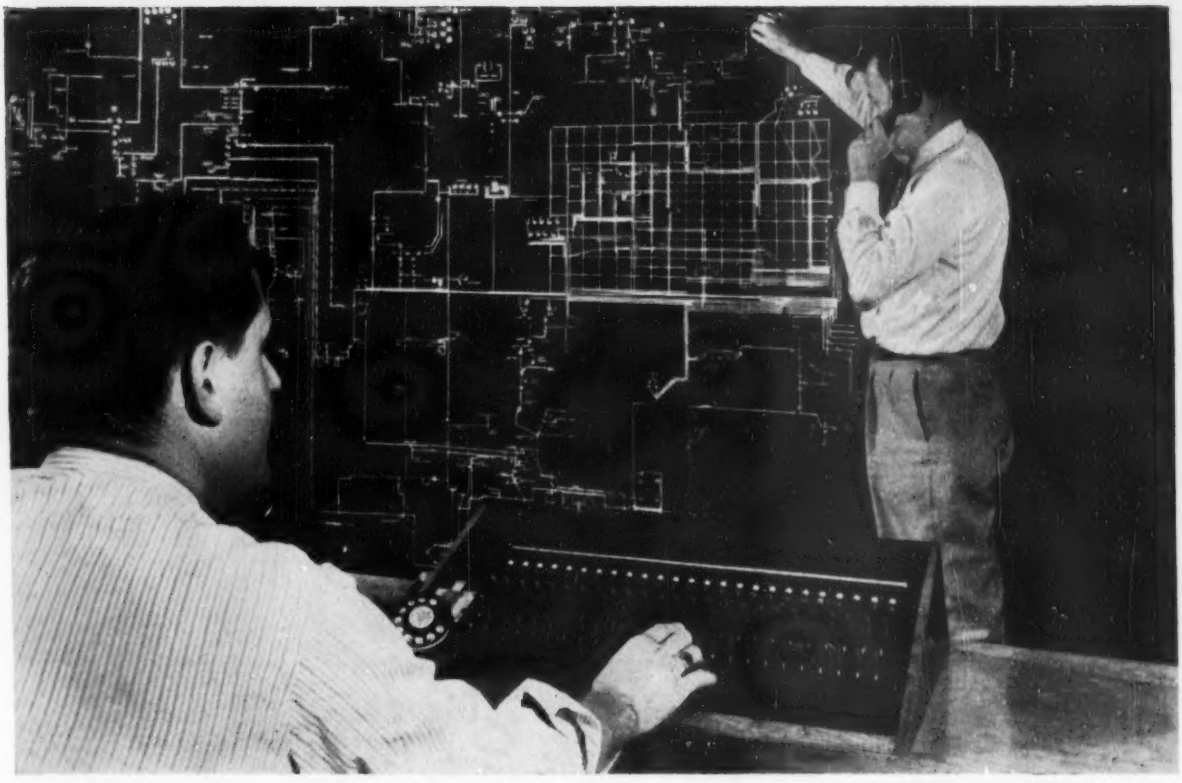
THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 2
Exide Batteries of Canada, Limited, Toronto

1888 ... DEPENDABLE BATTERIES FOR 66 YEARS ... 1954

"Exide" and "Manchex" *Reg. T.M. U.S. Pat. Off.*



One-half of installation of 60-cell FME Exide-Manchex battery in Moss Landing plant.



We take the worry out of your communications

Your business is power. Growing rapidly . . . improving continually, it is extremely complex in itself. Why complicate it more?

Our business is communications; let us take over your communications worries. With the Bell System you get the best services available.

Here's why:

1. Communications have been Bell System's special business for more than 75 years. That's why we have the best equipment and skilled personnel to maintain and install it.

2. Bell System experts tailor your communications to fit your changing needs exactly—neither too much nor too little—whether it's private-line or mobile telephone or teletypewriter services; or channels for remote metering, protective relaying or supervisory control.

3. New developments and techniques are continually available to Bell System engineers in meeting your specific requirements.

4. Your Bell System services are protected to assure reliability—alternate routings are an integral part of planning to meet any emergency.

Forget the headaches of investing capital for communications equipment. Ask your Bell Telephone Company to study your communications problems and needs. There is no charge for this survey.

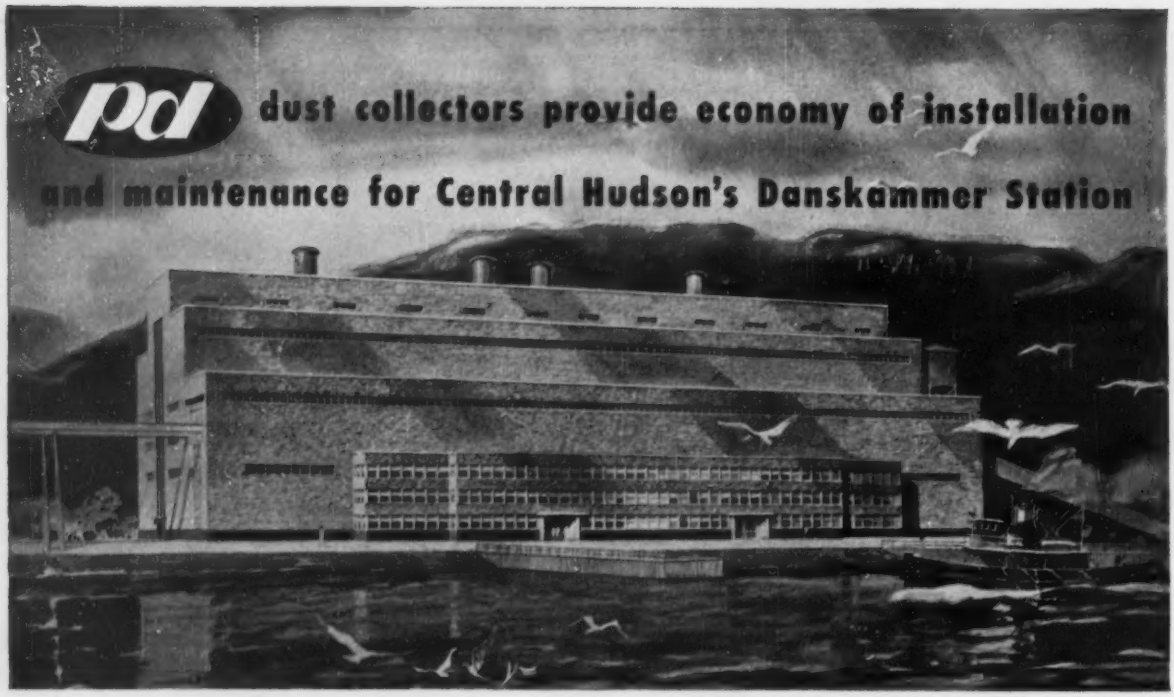
PRIVATE-LINE TELEPHONE

TELETYPEWRITER

MOBILE TELEPHONE

METERING CHANNELS

BELL TELEPHONE SYSTEM



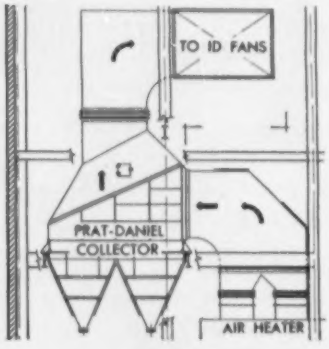
Exclusive Prat-Daniel Unibloc Construction Reduces Erection Costs

For assured efficiency, Prat-Daniel Dust Collectors were chosen to handle a 500,000 lbs. per hour continuous steam load on this installation.

Minimum space requirements were made possible by the small tube diameter. This feature also is responsible for the exceptional efficiency of these collectors. Greater centrifugal force is realized in a small diameter tube, increasing collection efficiency in the finer particle range below 20 microns.

Assembled in complete Unibloc sections at the factory, Prat-Daniel Collectors require less time for erection in the field. They are well known for their long life. Tubes examined in other installations after a period of ten years showed little or no signs of wear, even though subjected to continuous heavy dust loading.

Project Engineers for Prat-Daniel, The Thermix Corporation cooperated with Burns and Roe Inc. of New York, Consulting Engineers on the Danskammer Station. Thermix are specialists on dust collection . . . why not contact them for the answer to your problem.



Ask for the new P-D catalog 4P201

Catalog contains charts, nomographs, tables and efficiency curves on how to select a dust collector. You will want this valuable information for your files. Write for your copy today.

Project Engineers for Power Plant Division

THE THERMIX CORPORATION

GREENWICH, CONN.

(Offices in 38 Principal Cities)

Canadian Affiliates: T. C. CHOWN, LTD., Montreal 25, Quebec; Toronto 5, Ontario

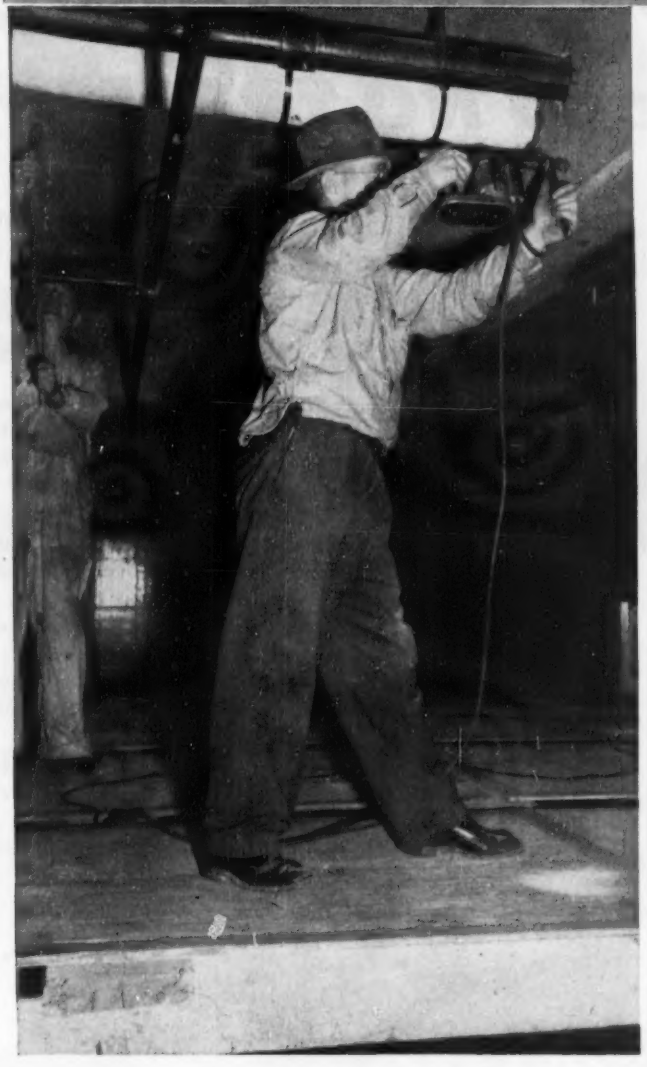
Designers and Manufacturers

PRAT-DANIEL CORPORATION

SOUTH NORWALK, CONN.

POWER DIVISION: Tubular Dust Collectors, Forced Draft Fans, Air Preheaters, Induced Draft Fans, Fan Stacks

Maintenance Crews Won't Wait!



When conditions demand changes in buildings or machine layout, maintenance crews won't take the time to keep portable cords in the clear. Portable cords must be able to take all kinds of abuse and still operate dependably day in and day out. Portable maintenance equipment — drills, lamps, welders, etc. — depend on their continued operation.

To get your production lines in operation and keep them that way, give your skilled mechanics and maintenance crews a reliable portable cord. That means TIREX. These cords have a tough, *selenium-neoprene* armor that is *cured in lead.* This tough jacket gives balanced resistance to oil, grease, acids, flame, abrasion, snagging and tear.

To keep your maintenance tools in the very best condition, be sure that they are equipped with Simplex-TIREX Portable Cords. You can get them from your electrical distributor. Specify and be sure you get Simplex-TIREX Cords They are marked for your protection.

Simplex WIRES & CABLES

TIREX CORDS AND CABLES *are made only by the*

SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Massachusetts

30 years unfailing and NO TRACE of

TIME-TESTED . . . PERFORMANCE-PROVED

Through 30 years of uninterrupted service, this multi-gap resistance type arrester has protected the lines of a large Southern power company. "Service-engineered" by ESM Co. for long-life dependability, its porcelain housing was ventilated.

Examination of the unretouched photos of the gap assembly show that ventilation kept the interior always dry and clean. All electrodes were still in perfect operating condition . . . no trace of gap corrosion.

For 17 years the same time-tested advantages of gap ventilation have eliminated all moisture trouble from Crystal Valve Ventilated Gap Arresters. Free access of air in and out of housing means no moisture can accumulate to corrode gap electrodes, cause arrester failure. Result: A practically 100% record of perfect protection on thousands of installations all over the world.

For positive protection on every line, get the time-tested performance-proved reliability of Crystal Valve Ventilated Gap Arresters.

Write today for illustrated folder with full details.

After 30 years, all electrodes are still smooth, clean and uncorroded by moisture.

Secret of 30 years' dependability lies in gap ventilation through this opening in lower cap. Same principle assures reliability of today's Crystal Valve Ventilated Gap Arrester.

protection...

GAP CORROSION!

CRYSTAL VALVE

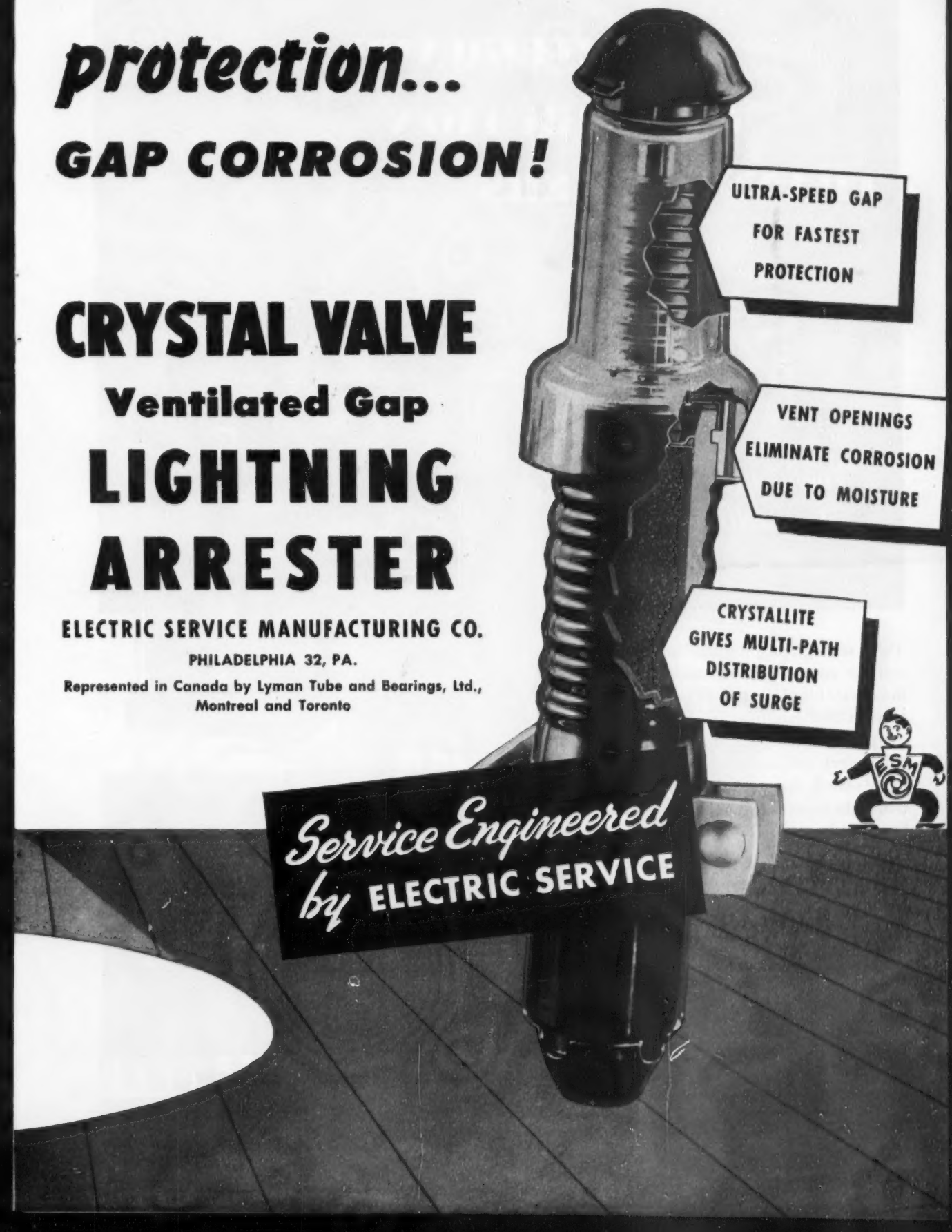
Ventilated Gap

LIGHTNING ARRESTER

ELECTRIC SERVICE MANUFACTURING CO.

PHILADELPHIA 32, PA.

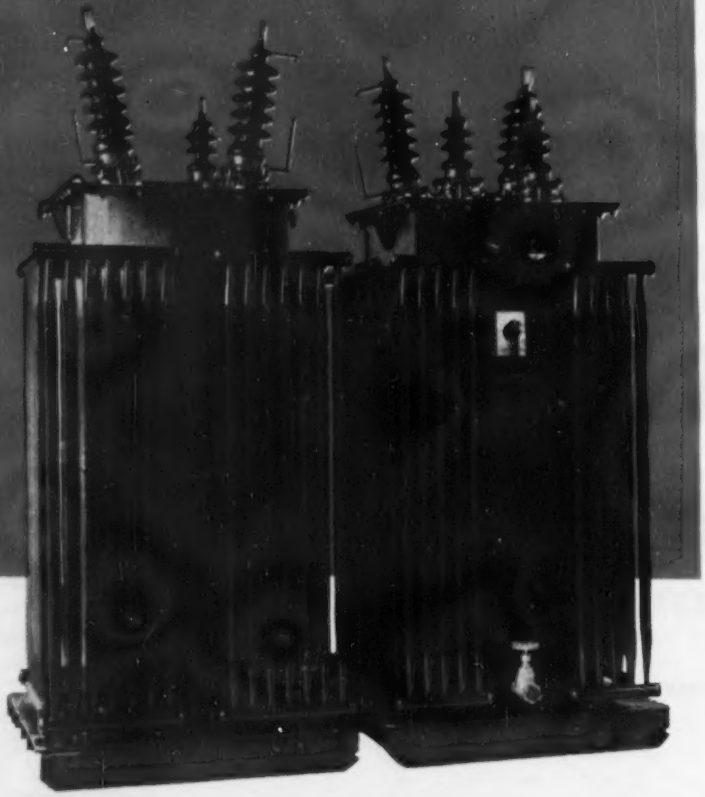
Represented in Canada by Lyman Tube and Bearings, Ltd., Montreal and Toronto


ULTRA-SPEED GAP FOR FASTEST PROTECTION
VENT OPENINGS ELIMINATE CORROSION DUE TO MOISTURE
CRYSTALLITE GIVES MULTI-PATH DISTRIBUTION OF SURGE
ESM
Service Engineered by ELECTRIC SERVICE

UPTEGRAFF DISTRIBUTION TRANSFORMERS

SEALED TANK CONSTRUCTION

means longer-life low maintenance



Tight sealing that prevents "breathing" and the entrance of moisture, prolongs the service life of Uptegraff Transformers. Oxygen and moisture are found to be the principal causes of oil deterioration. All flanges and openings are so effectively sealed, that even the keen perception of the super-sensitive electronic Leak Detector does not find any sign of leakage.

This is only one of many features that give Uptegraff Transformers exceptionally long life expectancy, and reduce maintenance costs.

Uptegraff makes distribution transformers in all commercial ratings, from 3 KVA to 500 KVA, and in a complete series of dry type air-cooled designs, as well as the liquid-filled units.

Every liquid-filled Uptegraff Distribution Transformer is checked by the electronic Leak Detector before shipment. The photograph above shows front and rear views of a single phase, 60-cycle, 26,400–13,100Y/7560 volts, 500 KVA transformer.

R. E. UPTEGRAFF MANUFACTURING COMPANY

Scottdale, Pennsylvania

NEW INTERNATIONAL MEDIUM-DUTY FOUR-WHEEL DRIVE TRUCKS

For Off-Highway or Highway Operation

Now, INTERNATIONAL Truck advanced engineering makes possible another development in transportation efficiency—*two new medium-duty four-wheel drive models* that open new possibilities for truck operators in scores of fields.

You can haul men, tools, equipment to any job—through mud, sand, and snow—over terrain where conventional trucks can't go. With front axle disengaged, you can operate normally on the highway.

Tough-job engineered. These new models are built for the toughest kind of work. Like every INTERNATIONAL, they give the low operating and maintenance cost and long life that have made INTERNATIONAL the heavy-duty sales leader for 21 straight years.

These new INTERNATIONAL 4x4 models have the stamina, ruggedness, and versatility for the toughest jobs. See one today. See how it fits your work. Time payments arranged. See your INTERNATIONAL Dealer or Branch for all the facts.

INTERNATIONAL HARVESTER COMPANY • CHICAGO

New **INTERNATIONAL R-160** (4x4) with public utility equipment, including front-end winch. GVW rating, 11,000 lbs. Famous Comfo-Vision cab.

Brief Specifications of these new INTERNATIONAL medium-duty 4x4 models

Two chassis models. Model R-140 (4x4)—130-inch wheelbase, 60-inch CA; 142-inch wheelbase, 72-inch CA, GVW rating 11,000 lbs. Model R-160 (4x4)—154-inch wheelbase, 84-inch CA; 172-inch wheelbase, 102-inch CA, GVW rating 15,000 lbs.

All-truck power. Model R-140 (4x4), 100-hp. Silver Diamond 220 valve-in-head engine. Model R-160 (4x4), 108-hp. Silver Diamond 240 valve-in-head engine.

Eight forward speeds, two reverse. Transmission has four forward speeds, one reverse, with 2-speed transfer case.

Easily converted for highway use. Special transfer case permits disengaging front axle for normal 2-wheel drive operation.

Transmission power take-off openings on right and left side to handle front-mounted winch.

International Harvester Builds McCORMICK® Farm Equipment and FARMALL® Tractors . . . Motor Trucks . . . Industrial Power . . . Refrigerators and Freezers

Better roads mean a better America

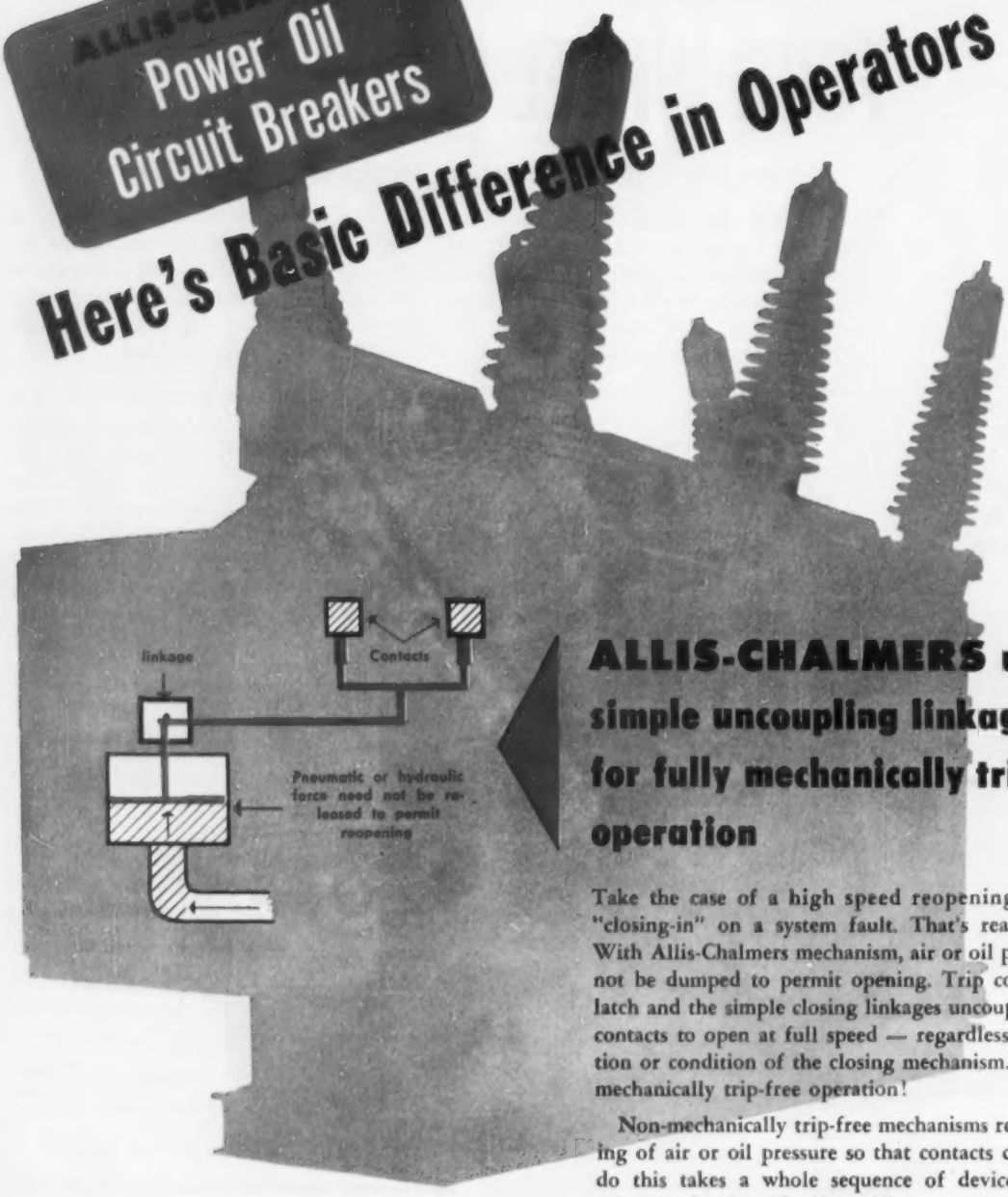
INTERNATIONAL® TRUCKS

"Standard of the Highway"

ALLIS-CHALMERS

Power Oil Circuit Breakers

Here's Basic Difference in Operators



ALLIS-CHALMERS uses simple uncoupling linkage for fully mechanically trip-free operation

Take the case of a high speed reopening following "closing-in" on a system fault. That's really the test! With Allis-Chalmers mechanism, air or oil pressure need not be dumped to permit opening. Trip coil releases a latch and the simple closing linkages uncouple, allowing contacts to open at full speed — regardless of the position or condition of the closing mechanism. That's fully mechanically trip-free operation!

Non-mechanically trip-free mechanisms require dumping of air or oil pressure so that contacts can open. To do this takes a whole sequence of devices, including valves and solenoids. Everything must work perfectly, or breaker will be held closed or slowed in opening.

This truly simple operator principle has been a feature of Allis-Chalmers breakers since 1933. For further details call your nearby A-C district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4219

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

NEW

15-WATT {6/12 VOLT / 25-50 MC} 2-WAY RADIO

MC 3
Receiver-Transmitter ES-22

- ✓ **Compact, *single-package* design for installation convenience!**
- ✓ **Versatile 6/12 volt operation!**
- ✓ **Low transmit and standby battery drain!**
- ✓ **Delivers the most for your communication dollar!**
- ✓ **Optional front mount control unit available!**
- ✓ **Converts quickly . . . inexpensively to narrow band use!**
- ✓ **The exact sensitivity . . . selectivity you need!**

ONCE AGAIN General Electric meets your exact communication equipment requirements! The evident waste in using more powerful 30 or 60 watt units where they are not needed is banished by this latest G-E receiver-transmitter design. It incorporates all the operating and convenience features you prefer. Here is the true economy set that rounds out your General Electric communication system . . . famous nation-wide for finest performance . . . lowest maintenance costs!

YOUR CAS* MAN will demonstrate this mobile unit . . . supply you with complete information on its uses. Call him today at our local General Electric office or mail the coupon at right.

* *Communication Advisory Service*

GENERAL ELECTRIC

General Electric Company, Section 1914
Electronics Park, Syracuse, N. Y.

Please send me complete details of this new 15-Watt Low Band Communication Equipment.

NAME.....

COMPANY.....TITLE.....

ADDRESS.....

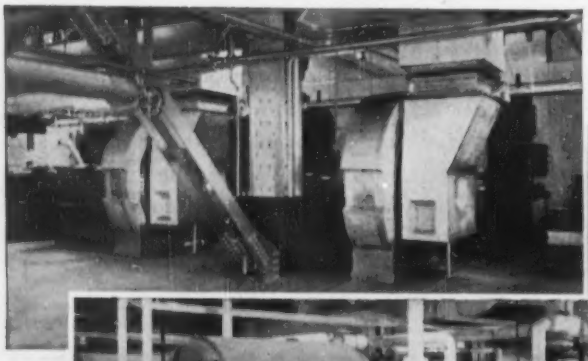
CITY.....STATE.....

American Blower

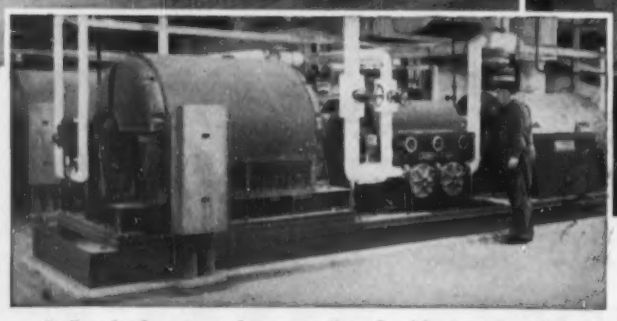
Reports on Progress in Power

New Justin R. Whiting Station, Erie, Michigan. Architect: Carl C. F. Kressbach. Engineers: Commonwealth Associates, Inc.

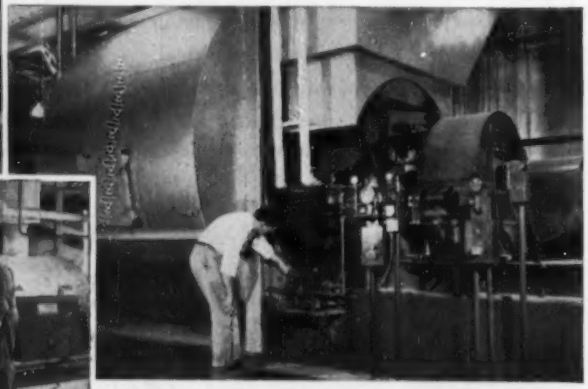
Consumers Power prepares for



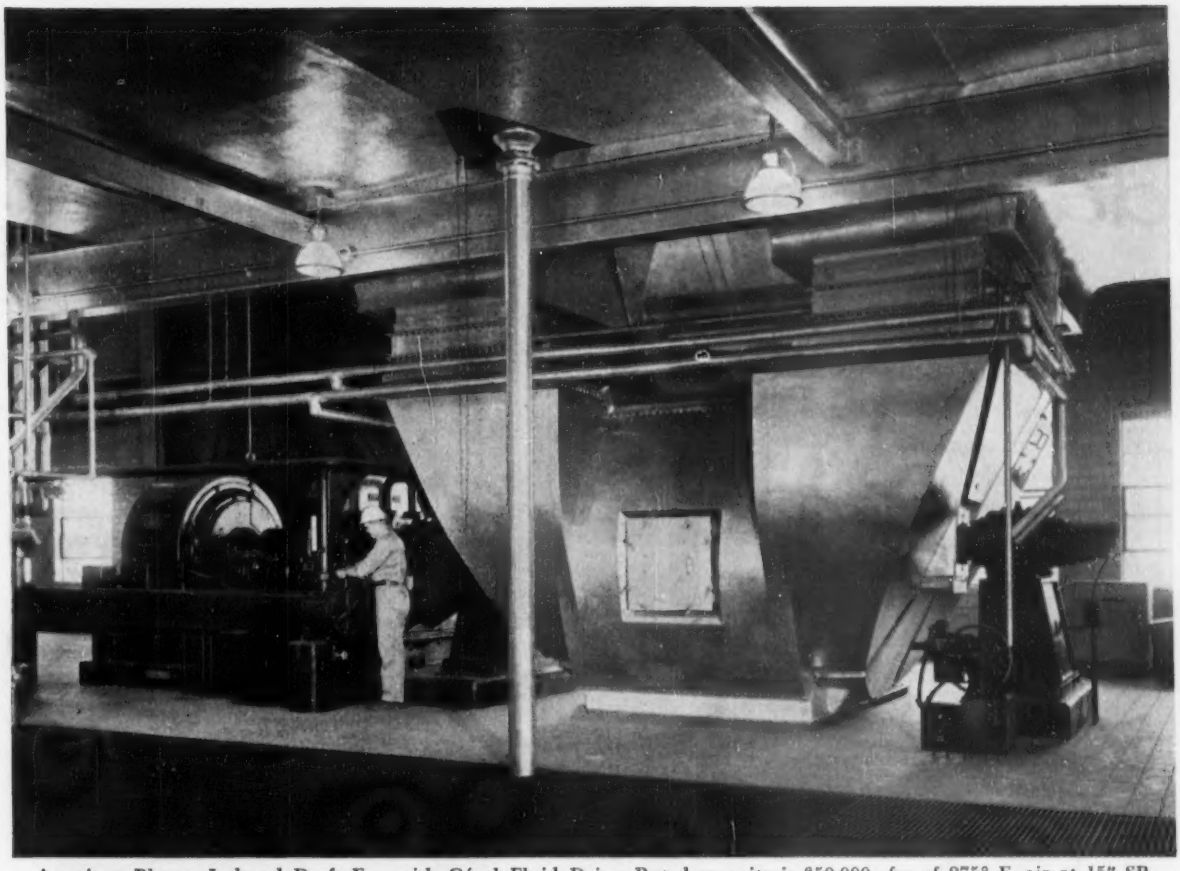
←
Shown are 2 of 12 American Blower Primary Air Fans, each with a rated capacity of 18,700 cfm at 29″ wg air at 495° F.



Boiler feed pumps shown equipped with American Blower Gýrol Fluid Drive control, have a rated capacity of 1600 gpm of 300° F. water at 1775 psig discharge and 75 psig suction.

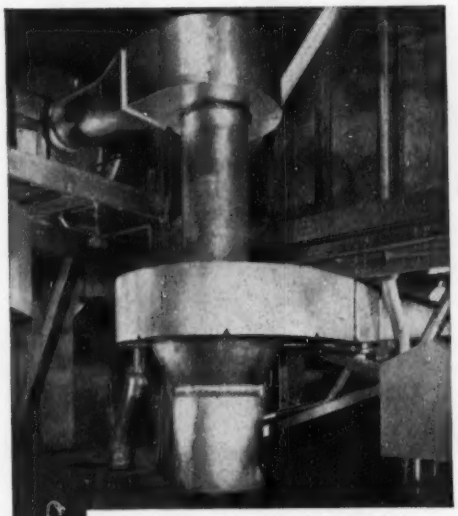


Each of the three American Blower Forced Draft Fans is equipped with a Gýrol Fluid Drive for smooth stepless fan control.



American Blower Induced Draft Fan with Gýrol Fluid Drive. Rated capacity is 350,000 cfm of 275° F. air at 15" SP.

future with new Whiting Station



American Blower Fly Ash Precipitators and secondary dust collectors are installed on all boilers of the Whiting Station. Shown above is one of two secondary collectors on Boiler No. 2.

Michigan's Consumers Power Company has a reputation for pioneering.

Among the first to transmit over 100,000 volts over high tension wires, they also have an impressive record in the development of rural electrification.

Now, anticipating future needs, the Justin R. Whiting Station, their sixth modern steam plant, is already in operation. Named after Consumers' chairman of the board, it has a rated output of 276,000 kw.

American Blower products, including Mechanical Draft Fans, Dust Collecting equipment and Gýrol Fluid Drives for boiler feed pump and fan control, play an important part in the efficient operation of this and other Consumers Power plants.

If you are planning to modernize or expand your facilities, American Blower engineers, located in all principal cities, will gladly cooperate with you.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary Corporation

AMERICAN BLOWER

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

Not by a dam site

Appliances, commonplace in today's living, are in the *home* . . . far removed from the *dam site!* In between, is a problem . . . voltage regulation . . . the result of long line voltage drop. To eliminate the problem a pole type step voltage regulator can be introduced into your distribution system where the load exists. The particular demands of your system will determine where you install the regulators.

The features of pole type step voltage regulators will determine what regulator you will install. Specify and install Moloney Pole Type Feeder Voltage Regulators because . . .

MES4-2

- COMPLETELY SELF CONTAINED
- FLEXIBLE CONTROL CABINET MOUNTING
- HIPERCORE WOUND CORE DESIGN
- COMPLETELY OIL IMMERSED UNIT
- GREATER ARC CLEARANCES
- SPRING LOADED ACTION ON THE SELECTOR SWITCH
- SENSITIVE, ACCURATE CONTROL SYSTEM
- FULLY AUTOMATIC OPERATION
- QUICK, EASY INSTALLATION
- LONG, TROUBLE-FREE OPERATING LIFE

MOLONEY ELECTRIC COMPANY

Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers • Step Voltage Regulators • Unit Substations

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONT., CANADA

Modern Buildings Demand Higher Voltage

Another standard service voltage is in prospect for large modern buildings. Loads have begun to outgrow the conventional 120/208-v system. This is particularly true of air-conditioning motors. Loads approaching 10,000 amp or more at network voltage in a single building require large and costly conductors. The list of buildings which already have service at 480 to 575 v for at least part of this load is growing.

For nearly 30 years the 120/208-v ac network has given outstanding service to commercial areas. Its proven reliability and economy have won acceptance in over 150 cities here and abroad. Combined light and power service has beeome common practice.

But now its adequacy is challenged for the larger buildings. Heavier loads threaten to upset its economies in favor of higher service voltages. Combined light and power at this new voltage level brings serious problems. But the potential advantages assure their speedy solution.

Choice must be made between 240/416, 266/460, and other possible combinations such as 277/480. The first combination might permit continued use of present types of wall switches rated for 125/250-v service. The second would require the use of new switches recently developed for the higher voltage. Fluorescent lamps for either voltage would be the same as those now used, but special starters and ballasts would have to be provided. Desk lamps, small appliances and similar applications would be served through small auto-transformers supplying receptacle outlets. So lighting requirements do not require compromise voltage standards here as they did for the 120/208-v systems.

Motors are the key to this selection. Standard rating for them is 440 v. And at 460 v they operate well within their design tolerance. This higher voltage appears preferable to 416 v where motors would face the same difficulties they now experience at 208 v. Because new lighting standards are required for either voltage, the logical choice appears to be 266/460. Service at this voltage to large commercial buildings has recently been proposed by Consolidated Edison Co of New York.

Progressive architects and construction engineers should consider seriously this new offering. For in the new service voltage is opportunity for substantial savings in building electrical system investment. Figures have been cited up to 25% saving, where extensive provision of 120-v outlets can be avoided.

Utilities likewise gain economies, for they can use larger transformers without a corresponding increase in current rating of the network protectors.

Spot networks are a convenient and reliable means for supplying these higher voltages. They can be supplied by the same feeder cables which serve the existing network. Operation of the feeder system follows established practice. Thus the new service voltage can be provided in 120/208-v areas without serious dislocation of system practices.

Requirements resemble those of 20 years ago when the spot network was created to serve modern office buildings where prevailing service was radial or dc. Then it contributed to subsequent development of 120/208-v street networks. History could repeat itself tomorrow at the new service voltage. Now is the time for utilities to explore their needs and act promptly to secure the fullest advantages inherent in a new service voltage.

And Now, Color TV

It's here, officially. Actually though color television is still quite a long way ahead for the people who will look at it. Comparatively few—one estimate is 200,000—receivers will be produced in 1954, and probably most of them will not reach the retail market until late in the year. The pictures will be small, and the prices will be high in comparison with those of the black and white receivers now being sold.

The receiver hurdle is not the only one for color television to get over. There is another at the transmitting end. More elaborate, more complex equipment, and problems in the techniques of presentation mean higher costs for program sponsors. The price of a TV show is plenty high now. Many advertisers will cringe and mutter in their beards when they learn what they will have to pay for a color show.

No figures on the electricity requirement of the color receiver have yet been bandied about. But it is likely that the requirement will be considerably higher than for receivers now in use. This is something to which the electric utilities should give prayerful thought. Evidently they will have time for such cogitation. But time has a habit of running out. It is not too soon for utility engineers and rate men to begin to think about what color television may amount to in terms of electric service.

Capacitors Lagging in Acceptance

The C in R, L and C stands for capacitance. That much many engineers remember because their professor used to assign them RLC problems. But there are plainly many electrical engineering graduates who never accepted the reality of capacitance as readily as they did reactance. Somehow rolling up some aluminum foil between layers of paper does not seem as physical an electrical entity as stacking up iron laminations for magnetic purposes. In short the magnetic field, its reactance, and the lagging current associated with it have far less mystery than the leading current that goes with establishment of an electrostatic field.

Reason why capacitance was so late in getting started as a tool for offsetting the effects of excessive reactance is probably associated with this difference in accepting the educational concepts. In fact most of the progress made in correcting system conditions by resort to capacitors has probably been based on the empirical results obtained rather than on appreciation of the theoretical benefits.

Something like a third of the utilities have gone all out for capacitors. Another third have gone part way in deriving their benefits. The third third seem to have done nothing about capacitors. Maybe their circumstances hardly justify use of capacitors. More likely they just are blind to the gains obtainable from capacitors—look upon them as a mathematical trick.

For such folks the standard arguments still hold; namely, that capacitors facilitate power factor correction, facilitate better voltage conditions, and help release system capability tied up with reactive kilovars. Just in case those benefits have been claimed so long and so repetitively as to have become trite, the dollar sign might be allowed its appeal. What else can be bought at $4 or $5 per kva? More common figures for other equipments range upward from $30 or $40. So maybe the reluctant managements would have their eyes opened if they just reversed the approach. Let them ask their engineers this—where can we use some $5 per kva equipment advantageously on our system? They can expect recommendations based on capacitors.

What Chance Has Mrs Murphy?

The more electrical appliances sold, the bigger becomes the problem of servicing them. The editorial brain did not have to be revved up very much to reach that conclusion. But we wonder if the collective brain of the appliance industry—manufacturers, distributors, retailers, and utilities included—is turning over fast enough to have yet arrived at that obvious truth.

No, we have no figures of thousands of customers biting their fingernails in exasperation as their beautiful ranges, clothes washers, dryers, or whatever refuse to perform as advertised because some gadgets inside them have gone temperamental.

But we do know about a sales executive of a straight electric utility whose new dishwasher has been standing idle for weeks while a replacement for the diffugulator, or something of the kind, is on its way from the factory by slow freight via Timbuktu and points east. We know because he telephoned to tell us about it and to suggest we print something about it. Hence this piece.

And it does look bad. If a sales executive of a straight electric—not a combination—utility can't get service, then what chance has Mrs Murphy?

Keep Up to Date

Edison Electric Institute has just released its sixth annual edition of "I Want to Know about the Electric Industry." Like its predecessors this booklet is intended to bring the uninformed and information-seeking the answers to 28 questions frequently addressed to the institute. That this booklet is merely an old one brought up to date does not detract from its great value. And as Electrical World has urged when past editions appeared, it again urges all industry companies to make use of this great instrument in keeping the civic and community leaders in their areas up to date on the progress of the industry. Copies can be secured from Edison Electric Institute, 420 Lexington Ave., New York 17, N. Y.

"Kilowatt Comfort"

"You can heat your home with electricity. That's not just a theory, but a highly practical fact attested to by thousands of comfortable home owners."

So begins the article, "Kilowatt Comfort," in the winter, 1953, issue of the "Union Electric Quarterly" published for its employees by the Union Electric Co of Missouri. No better, no more readable, statement of the values and amenities of electric heating, of its various forms and of its applicability has yet come to our notice. We congratulate the un-named author on an excellent writing job, also Union Electric for perspicacity and vision in printing it.

THE ELECTRICAL WEEK

The Issue's News Highlights—Republicans in Congress and Administration are charting plans to reconcile federal power policy with rural co-op needs . . . TVA celebrates 20th anniversary with record-breaking year.

General Electric asks Army Corps of Engineers to reconsider contract given to British firm for McNary Dam generators . . . Dr William A. Pearl is named BPA chief . . . Nema spokesmen predict electrical industry's 1954 shipments will come close to last year's record $15.5 billion.

Columbia Basin Inter-Agency Committee soon may take over planning operations of Bonneville Power Administration. This was indicated by an announcement that the committee plans to discuss creation of a technical subcommittee on power requirements and programs at a meeting to be held in Boise Jan. 13.

Jamestown, N. Y. was blacked out at 4:50 p.m. Tuesday when a flashover on a disconnect switch on the main bus shorted all machines in the municipal power plant, according to Superintendent Clayton O. Johnson. Power was restored throughout the city about 11 p.m.

The proposed Echo Park Dam and its 200,000-kw power plant will face united opposition of 32 wildlife and recreation groups during hearings on the Upper Colorado River Storage Project starting Jan. 18. Opponents will fight the proposed dam, in Dinosaur National Monument, as an invasion of the nation's park system. They'll use USBR figures to show that alternate sites would produce the same benefits at lower cost.

New York's Governor Dewey got in some licks at both federal and private power developers in his 1954 message to the state legislature: "Our St. Lawrence (FPC) license represented a victory over the public power extremists on the left who wanted to trample over the states and set up a vast federal hydroelectric monopoly. The private Niagara bill, on the far right, seeks to have the federal authority trample over our state law and policy in the opposite direction—for private exploitation. We must resist the second extreme no less vigorously than the first . . . During a 50-year license period the private bill would cost this area's consumers $1.5 billion more than the New York Plan."

On the opposite side of the coin, New York Chamber of Commerce announced its endorsement of the five-company bill, already passed by the House, which would permit development of 1.1 million kw of additional hydro power from Niagara River by private enterprise.

A three-way union fight at Westinghouse Electric's Lester plant in Philadelphia will be decided Thursday when 7,000 production and maintenance workers will ballot in an NLRB representation election. Unions involved: United Electrical Workers, independent, whose Local 107 now represents the workers; CIO International Union of Electrical Workers; and AFL International Association of Machinists.

Off the Washington Wire . . . Eisenhower Administration will run into stiff opposition in Congress if it recommends a further stretch-out of large Pacific Northwest hydro projects. Chief Joseph and The Dalles are main projects involved.

Emergency-born fast tax amortization of new plants may be carried over into long-range legislation and applied on a general basis. Administration and the House tax-writing committee agreed industry should be allowed to depreciate two-thirds of the cost of new investment during half the life of the project. Ordinarily, depreciation for tax returns is distributed equally over the project's life.

Delayed reports from AEC may hold up hearings on revision of Atomic Energy Act. Administration proposals for revision are still going the rounds of government agencies . . . AEC budget requests reflect a slim civilian power reactor building program for the coming fiscal year. Only project scheduled is the 66,000-kw plant Westinghouse will build.

National Association of Electric Companies, Sen Estes Kefauver (D-Tenn.) told the International Platform Association, is "working hand-in-glove with Administration officials" to undermine the public power program.

Fluorescent lamps are under study in Ontario for application to street lighting. Focus of study is on characteristics of reduced output and difficulty of cold weather starting.

Atlantic City's famous boardwalk became the "Great Light Way" as Mayor Altman threw a switch which bathed the esplanade with glareless light from 123 new 33,000-lumen mercury lamps. Ceremony was first formal event of the city's Centennial Celebration and Light's Diamond Jubilee.

Virginia E&P received State Corporation Commission approval to raise rates about $4.8 million a year March 1.

Delaware PSC has denied a Delaware P&L petition to supply power to Dover Air Force Base. Base will continue to receive power from Dover municipal plant.

Northern Indiana Public Service will offer 318,000 shares of common to its stockholders on a 1-for-10 basis.

PUAA's Better Copy Contest has a deadline of Feb. 1 for all entries except those in the annual report classification, which closes April 1.

Executive Changes . . . Floyd D. Campbell, president of New England G&E Association, was elected president of NEGEA Service Corp to succeed Frank W. Randall, who becomes board chairman and consultant to the corporation . . . Philadelphia Electric named Edward Porter senior vice president. Porter's former post of vice president of finance will be filled by Albert S. Corson, formerly comptroller.

GOP Mapping Interior-Co-op Liaison

Reconciling federal policy with rural power needs is aim of:

- **House and Senate investigations**
- **Newly created REA Advisory Committee**

Republicans in Congress and in the Administration are stepping up efforts to reconcile new federal power policy with the needs of rural electric cooperatives. Recent moves include:

- Hearings by the House Interior Committee aimed at determining the effect of power policy on rural co-ops.
- First meeting of the newly created Advisory Committee of the Rural Electrification Administration.

General purpose of both these actions appeared to be to create a clearer understanding of power policy as it relates to the electric cooperatives, but Democrats on the Congressional committee seized the opportunity to try to embarrass the Republicans.

Liaison Created . . . At the conclusion of a two-day meeting of the REA Advisory Committee, Administrator Ancher Nelsen announced that close liaison had been established between REA and the Interior Department to work out further power policy moves.

Previous testimony at Senate and House hearings had disclosed REA was not consulted when Interior put out its controversial power marketing criteria for Missouri River Basin projects. Nelsen indicated that provision has now been made to coordinate policy moves affecting co-ops.

Members of the advisory committee were also invited to confer with Interior officials regarding past and future policies affecting co-ops.

Pleasure on All Sides . . . While few definite decisions were made at the Advisory Committee meeting, both Nelsen and a spokesman for the other committee members appeared pleased with progress made.

T. E. Craddock, manager of the B-K Electric Co-op of Seymour, Tex., spoke for other committee members in expressing the hope that much good would come from the meetings.

One purpose of the first meeting, said Nelsen, was to isolate problem areas in order that REA might concentrate its assistance on them. He reiterated a previous statement that REA would continue to make loans for generation and transmission facilities if these are necessary to assure power supplies for co-op borrowers.

Aandahl on Hand . . . Assistant Interior Secretary Fred G. Aandahl met with the Advisory Committee to discuss and explain the Interior policy for marketing power in the Missouri Basin.

The Missouri Basin marketing criteria was also a key target at the House committee hearings. This hearing brought out much of the same information previously gathered by a Senate committee looking into power policy (EW, Dec. 21, p 8).

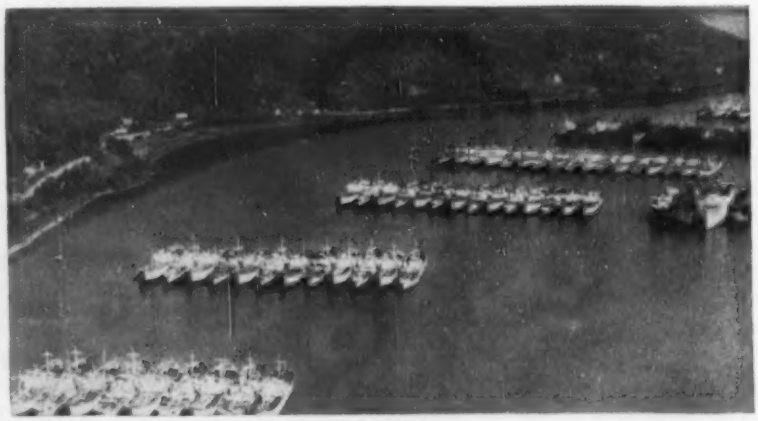
Democratic Rep Clair Engle of California said he wanted to find whether Interior was favoring electric companies at the expense of public bodies. He asked whether the preference clause was being fully protected.

In reply, Aandahl said the rights and privileges of preference customers were thoroughly protected under marketing criteria established by the new Administration.

Wise Dissatisfied . . . Interior explanations, however, did not satisfy former REA Deputy Administrator William C. Wise who is now attorney for a group of Missouri Basin electric co-ops. He said the policy administered by Interior could "hurt the co-ops severely."

Wise and his co-op clients were slowly picking up support on Capitol Hill where 26 senators and several representatives signed a letter urging that the Missouri Basin criteria be postponed for three months to give Congress and the Administration more time to study it.

Republican Rep Usher L. Burdick, a former congressional colleague of Aandahl, lashed out at the Interior policy. In a statement to newsmen, Burdick said any attempt to limit the operation of REA co-ops would mean "political suicide" for the party in power.



Electricity Guards Against Ship Corrosion

Corrosion protection is being supplied to about 150 merchant ships of the National Defense Reserve Fleet anchored in the Hudson River off Jones Point, N. Y. by Rockland Light & Power Co. It is being accomplished by cathodic application of 24-v direct current to the ships' bottoms. In the process, which is not harmful to human or marine life, small graphite electrodes have been laid on the river bottom beneath each ship and are connected electrically to rectifiers set up on the decks of selected vessels. Four substations have been completed, totaling 200 kva, which will supply all the requirements for cathodic protection, lighting, and small power through submarine cable to the ships.

TVA's 2 Decades . . .

. . . evaluated in annual report. Return on investment is the lowest in 11 years

Tennessee Valley Authority celebrated its 20th anniversary with another record-breaking year in power expansion, but rate of return on investment dipped to its lowest point since 1942.

Recently released report for the year ended last June 30 shows the agency added 1,145,600 kw of installed capacity to its own generating system. From other sources it acquired more than 90,000 kw during the period, bringing the total capacity of the integrated TVA system to 5,102,985 kw.

During this same period TVA power revenues climbed to nearly $105 million, an increase of $10 million over the previous year. But the severe drought in the area pushed operating expenses up $16.4 million above the previous year.

Investment Return Drops . . . Result was that return on the average depreciated investment in the power system fell to 2.7% for the year compared with an average return for the full 20 years of TVA operation of 4.1%. Since the agency is exempt from federal taxes, these are not included in the operating expense.

However, TVA ended the year by turning over $7.5 million of its net income from power operations to the U. S. Treasury as a repayment on funds appropriated by Congress. This brought total repayments to the Treasury up to $93.6 million.

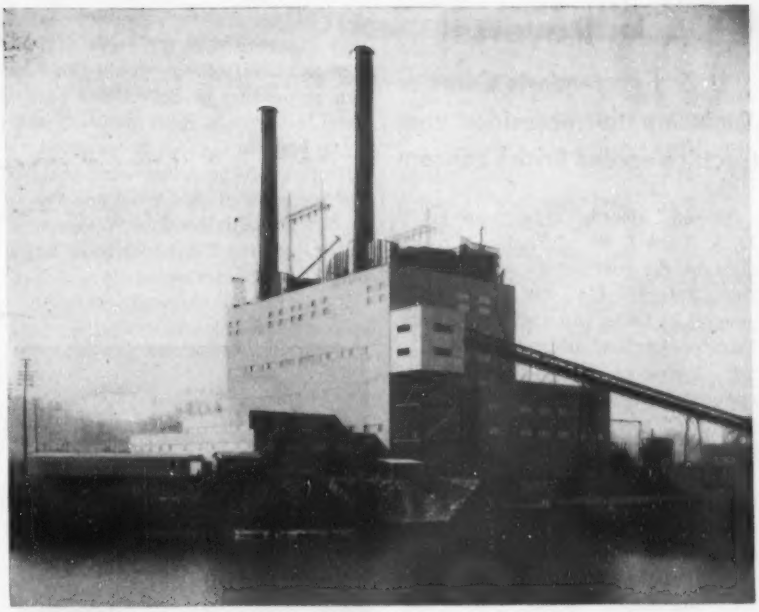
During the 1953 fiscal year, output of the TVA system was 23,744,919,000 kwhr of which hydro plants produced 13,933,290,000 and steam plants 9,811,629,000 kwhr. Because of the drought, hydro production was about 10% less than in the previous fiscal year, but with the steam capacity added during the year production at fuel plants more than doubled.

TVA realized an average of 4.40 mills per kwhr on its total sales—down from 4.68 mills for the previous year. Only rate increase in the past 20 years, says the annual report, was the adjustment of the lowest priced sections of the industrial rate schedule during the past year.

During the fiscal year, TVA had 50 generating units under construction at 17 dams and steam plants. Fifteen of these units were completed and placed in operation.

Transmission System Expanded . . . Transmission system of the agency grew by 762 circuit miles during the year to a total of 8,978 circuit miles. Of the total, 4,184 miles are 154 kv and the remainder in lesser voltages.

TVA claims that no other section of the country is devoting as great a proportion of total power supply to national defense needs. Use of TVA power by other federal agencies, rose from 2.8 billion kwhr in 1951 to 7 billion in fiscal 1953 and is scheduled to reach 28.4 billion kwhr in 1956. Atomic Energy Commission is by far the heaviest user among the other federal agencies.



AG&E Starts Up Another Major Plant

When Ohio Power Co's Muskingum River steam plant (above) went on the line Dec. 28, it became the 14th major power plant in the American Gas & Electric system in operation.

First unit at Muskingum has a capacity of 200,000 kw. A second unit of similar size is scheduled to start up in March. The plant is located near Beverly in southeastern Ohio on the Muskingum River.

Muskingum River Plant is a twin station of Appalachian Electric Power Co's Kanawha River Plant at Glasgow, W. Va. Kanawha has two 200,000-kw units in operation. First went into service July 16 and the second Dec. 31.

The two Kanawha units and the Muskingum unit represent 600,000 kw added by AG&E within six months. Both Ohio Power and Appalachian Electric Power are subsidiaries of AG&E.

BPA Plans $11,125,000 in Construction Outlays

Bonneville Power Administration has announced tentative scheduling of contract construction totaling $11,125,000 for the calendar year 1954 including current December contracts. Most of the new construction centers on transmission facilities to tie new generation at McNary, Chief Joseph, and other federal dams into the U. S. Columbia River grid. Other contracts represent transmission and substation additions to serve normal load growth.

Principal contracts to be awarded during the year include 51 miles of right-of-way clearing at an estimated contract cost of $279,000; 372 miles of transmission line construction, $8 million; 11 new substations, $1,860,000; and additions to 15 substations, $986,000.

GE Asks Reversal

U. S. firm requests Corps of Engineers to reconsider contract it awarded British concern

General Electric Co last week asked U. S. Army Corp of Engineers to reconsider the contract it awarded English Electric Co for two large generators to be installed at McNary Dam project and instead award it to GE, lowest American bidder. GE charged that the U. S. will be deprived of more than $1,159,000 in taxes, American workmen will lose wages for 1 million manhours of work, and national security might be endangered if the British firm builds the generators.

In a letter to the District Engineer at Walla Walla, Wash., James M. Crawford, GE vice president and general manager of the company's Motor and Generator Division, declared that while the bid of English Electric on the generators appeared to be lowest, it actually will cost the U. S. and the American people more than the lowest bid by a U. S. manufacturer.

Says Taxes Offset Gain . . . Although English Electric's bid of $3,651,476 was $641,225 lower than GE and the British company would pay an import duty of $422,000, Crawford said federal, state, and local taxes of $1,159,000 resulting from manufacture of the units by GE would more than offset a net gain of $1,063,225 which would seem to result from acceptance of the low foreign bid.

Crawford also estimated that $2 million in wages would be lost to American workers by award of the contract to English Electric. He said it would take 500 men working eight hours a day one year to build the machine. He added that wage rates in Britain are less than one-third those in the U. S. and the wage differentail is an important reason why U. S. manufacturers cannot equal prices of foreign firms.

Engineering Experience . . . The GE official also pointed out in the letter that English Electric had never built a generator the size of the unit to be installed at McNary whereas GE had built two such units which now are operating at the Columbia River project.

Crawford further raised the question of whether, in the event of war, foreign manufacturers would either be able to produce or deliver new equipment, or provide spare parts or service to keep equipment in operation.

Copies of the letter were sent to the Secretary of the Army and Office of Chief of Engineers in Washington, D. C., and the Corps' Division Engineer at Portland, Ore.

DR WILLIAM A. PEARL

. . . New BPA Chief

Director of Washington State State College Institute of Technology replaces Raver

Dr William A. Pearl, director of Washington State College Institute of Technology, will take office this week as head of Bonneville Power Administration. He was appointed to the job late last month by Secretary of Interior Douglas McKay.

Pearl replaces Dr Paul J. Raver who resigned recently to become superintendent of Seattle City Light.

Commenting in Salem, Ore., on his appointment of Pearl, McKay said: "He's the best man we could possibly get for the job. He's had ten years of business experience besides all kinds of engineering experience, including research in the power field."

Acting College President . . . Pearl was acting president of the State College of Washington from 1951 to 1952 and director of industrial research at the college from 1947 to 1949. Before that he was chairman of the mechanical engineering department at the college.

From 1935 to 1945 he was associated simultaneously with three Chicago organizations—Whiting Corp where his jobs included director of research and development, plant manager and vice president in charge of manufacturing; Illinois Institute of Technology, where he was professor of mechanical engineering and an adjunct professor in the graduate school; and Armour Research Foundation, where he was in charge of major projects as a member of the staff.

Pearl has B.S. and M.S. degrees in mechanical engineering from the State College of Washington and a doctorate from the University of Michigan.

National Electric Firm in Brazil Seems Unlikely

SAO PAULO (McGraw-Hill World News)—Reports from Brazil indicate that nothing will come from President Vargas' proposal for establishment of a national electric company.

It is believed that Vargas called for creation of the government power company "Electrobas" (EW, Dec. 28, p 63) in an attempt to stir up national feeling and bolster his waning popularity among the people.

It is also felt that the Vargas statement was intended to blackjack senators into approving a fund for power development already passed by the Chamber of Deputies. The Senate is expected to approve the electrification fund. Creation of an active "Electrobas" is unlikely, however, because the nation's income is insufficient. It would cost the government almost $6 billion to finance the 6 million kw envisioned by Vargas in ten years.

Oppose N. Y. Niagara Plan

The New York State Conference Board of Farm Organizations, composed of eight major farm groups, has renewed its opposition to state development of hydroelectric power at Niagara Falls. In a conference with Gov Thomas E. Dewey late last month board representatives urged that "the hydroelectric power at Niagara should be developed by private utilities."

Manufacturers' Prospects Good

Nema spokesmen estimate 1954 industry shipments to be 95 to 97% of 1953's record $15.5 billion volume

The electrical manufacturing industry expects to duplicate in 1954 the goal achieved in 1953, which saw an all-time high in business activity. This forecast has been made by W. J. Donald, managing director of National Electrical Manufacturers Association, and A. J. Nesti, chief statistician of the association.

The Nema spokesman said the estimated 1954 dollar volume for the industry would be 95 to 97% of 1953's $15.5 billion shipments of electrical products. They said the 1953 dollar volume of the industry was about 7% higher than the volume shipments of 1952.

All Electrical Shipments Up . . . All branches of the industry showed increased activity with the exception of building equipment and supplies, which suffered a decrease in sales in 1953 of about 5% from 1952. Shipments of insulating materials increased about 15%; appliances, about 10%; industrial apparatus, wire and cable, and illuminating equipment about 5%; and generation, transmission, and distribution equipment, and signalling and communication equipment, about 3%.

Among the factors cited by the Nema officials as contributing to the industry's high business activity were: (1) Additions made to generating capacity with almost 10 million kw of new capacity added in 1953; (2) sales of electrical energy which set a new record of over 380 billion kwhr sold; and (3) electrification of farms and industry continuing at increasing rates.

Donald and Nesti said the industry expects generation and transmission equipment volume of business for 1954 to equal 1953. This estimate is based principally on definite plans to expand generating capacity further with an estimated addition of another 11 million kw in 1954 and a further increase of output of energy amounting to an additional 27 billion kwhr.

Consumer earnings and expenditure, they said, brought about the new levels in sales of all kinds of electrical appliances which altogether were 10% higher in 1953 than they were in 1952.

Appliance Drop Seen . . . A 3 to 5% decrease in total dollar sales of electrical appliances is foreseen by the industry, the Nema executives predict. Substantial increases are forecast for such appliances as dehumidifiers, food waste disposers, dishwashers, room coolers, and television sets. However, a decrease of about 5% is expected for such products as electrical refrigerators, ranges, water heaters, and housewares.

Shipments of industrial apparatus are expected to fall off 5% in 1954.

Sales of insulated wire and cable are expected to be off 6½%, according to the Nema officials. Insulating materials, such as manufactured electrical mica, electrical porcelain, varnished fabric and paper, vulcanized fibre, may show a 10% decrease in 1954 compared with 1953, Donald and Nesti said.

Jersey Town Will Vote May 18 on Proposed Plant

Borough Council of Point Pleasant Beach has set May 18 as the date for a referendum to determine whether Jersey Central Power & Light Co should be allowed to construct a steam power plant on Gull Island in the Manasaquan River.

Citizen groups opposing construction of the plant who requested the referendum had asked that the vote be held Feb. 11.

In announcing the council decision, Mayor George Makin noted that the plant would not be constructed for six years and that there was no immediate need for action by the council. However, he said, the referendum would be held in compliance with the citizens' request.

In his statement, Makin also said: "During its investigation, the council has not found any evidence that a power station at Point Pleasant Beach would be detrimental from the standpoint of soot, noise, air pollution, and other nuisances as charged by opponents to the power plant. . ."

POWER BRIEFS FROM THE NEWS

● Cowlitz County PUD, Longview, Wash., has voted to join State Power Operating Agency No. 1. The operating agency, composed of four other PUD's and two cities, held a meeting last week to prepare an organization plan for submission to the State Power Commission.

● Construction programs for 1954 have been announced by the following utilities: Delaware Power & Light Co expects to spend $16 million with $9 million slated for newly authorized transmission and generating facilities and $7 million for previously authorized power plant expansion. Alabama Power Co's $105,570,029, three-year program calls for a $33,813,866 expenditure in 1954, $33,678,064 for 1955, and $38,078,099 in 1956. Consumers Power Co plans to spend $4 million in 1954 on improvements in its Jackson Division. Pacific Power & Light Co will spend in the coming year about $6 million; Southern California, $73 million; Portland General Electric Co, $8.5 million; and Dallas Power & Light Co, $1.3 million. Philadelphia Electric Co's estimated expenditures through 1958 amount to $310 million with $76 million scheduled for 1954, a record amount for a single year.

● Second 100,000-kw turbine-generator in the Walter C. Beckjord Steam Station of Cincinnati Gas & Electric Co has been put in service. A third 125,000 kw unit is slated to be placed in operation late in 1954.

● New York State Power Authority has borrowed $1 million from five New York City banks to finance preliminary work on St. Lawrence River hydroelectric project. Money borrowed will be used for engineering surveys and plans and specifications connected with the project.

● Cleveland Electric Illuminating Co has placed in operation the second generator at its new $85 million plant at Eastlake. The 125,000-kw unit will be followed by another in the spring and the fourth scheduled at the end of 1955.

Change in Atomic Policy Urged

Atomic Industrial Forum symposium concludes private interests should be allowed to develop commercial power reactors

The U. S. government's atomic monopoly should be relaxed to permit private interests to develop nuclear energy for commercial purposes, a group of specialists in the new field concluded at a symposium conducted by Atomic Industrial Forum, Inc, at New York.

The forum, an organization formed to press for private development of the atom, made this known in a report issued on the symposium, moderated by E. Blythe Stason, chairman of American Bar Association's special committee on atomic energy and dean of the law school of University of Michigan.

On the President's Proposal . . . To the report Stason added a comment on President Eisenhower's proposal for an international stockpile of fissionable material, which came after the AIF conference was held. He drew a parallel between that proposal and proposals now being made by private interests for changes in the Atomic Energy Act of 1946, which forbids non-government development. Both cases, he said, involve allocation or sale of uranium and fissionable materials, accumulated largely for military purposes, to those who are interested in atomic development for peaceful purposes.

He said: "If the United States could, by revising its domestic policies, provide a national example of what it envisions and hopes for on the international scene, it would do much in a concrete way to maintain its leadership and help steer the further development of atomic energy in the direction of the public good and of peace."

Stason said the following points had been made by participants in the symposium:

1. There is a clear need for economically competitive atomic power.

2. It is virtually certain reactor technology can be advanced to the point where atomic energy will be competitive with other sources of power.

3. Intensive development should begin immediately.

4. In addition to government research and development, from which private industry would benefit, free enterprise should be permitted—and encouraged—to participate as widely as possible.

5. To permit private participation, the present government monopoly in atomic energy should be relaxed as soon as possible, with government control through regulation substituted for the present method of government control through direct ownership and management of all fuels and basic facilities. Such relaxation should include the right of private interest to patent developments in the field.

What Was Said . . . Here are some commentaries made at the symposium, as compiled for the AIF report:

Gordon Dean, former AEC chairman now with Lehman Brothers in New York:

"I think the law should provide for ownership of fissionable material subject to certain regulations . . . I think ownership is a much more clean-cut arrangement than leasing from the standpoint of industry in connection with the handling of fuel elements."

Dr Lloyd V. Berkner, president of Associated Universities, Inc, which operates the Brookhaven National Laboratory for AEC:

"We have a transition period before us . . . Now the way to get through this transition period, to my mind, is not only to have the government build some of these experimental plants, as the AEC now plans to do, but also to make it possible for some

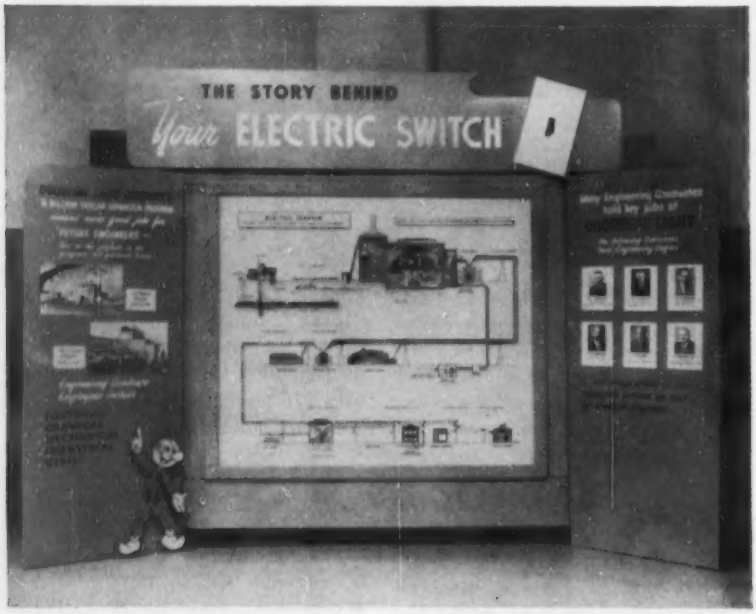


Exhibit Aimed at 'Future Engineers'

Duquesne Light Co was one of 14 Pittsburgh companies which furnished exhibits for a recent graphic exposition at Buhl Planetarium which outlined opportunities, prerequisites, and responsibilities of engineering careers to local high school students. Duquesne Light's exhibit (shown above) illustrates major steps in generation, transmission and distribution of electricity. At right side of exhibit are pictures of six key Duquesne Light men who hold engineering degrees.

Entitled "Engineers for Pittsburgh's Future," the exposition was sponsored by Engineers Council for Professional Development, Engineering Society of Western Pennsylvania, and Buhl Planetarium. Question and lecture sessions were conducted at the two-week exposition.

industrial organizations to construct privately owned plants."

Albert F. Tegen, president of General Public Utilities Corp, New York:

"We want atomic power if it is economical . . . The sooner we can get it, the better we will like it . . . I dare say, if you settle the problems about patents and if you settle the problem of types of reactors, I am not so sure there aren't a few power companies ready to build one. I am not so sure that the question of spending a huge sum of money on an experimental plant isn't one we wouldn't consider. We are a holding company not subject to state regulation. It may be that the SEC would allow us to develop an experimental plant under reasonably satisfactory conditions."

Others who took part in the symposium were: James A. Brownlow, president of AFL's Metal Trades Department; Leonard W. Cronkhite, president of Atomic Instrument Co, Cambridge, Mass.; Walter E. Kingston, general manager of atomic energy division, Sylvania Electric Products, Inc, Bayside, L. I.; and Casper W. Ooms, chairman of AEC's Patent Compensation Board.

Courts Rule Against WWP in Condemnation Cases

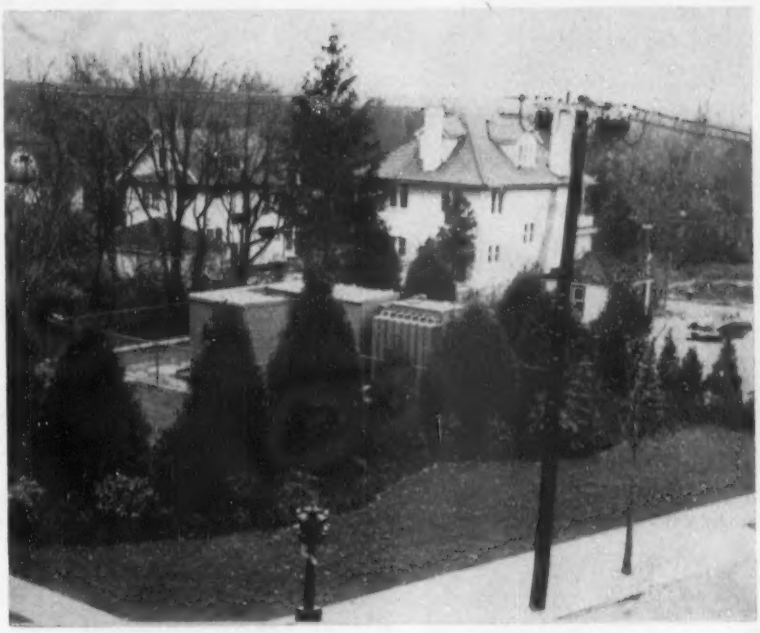
Washington Water Power Co this week lost two rounds in court battles against condemnation by county public utility districts.

A Superior Court judge ruled in Stevens County that seven citizens who opposed condemnation of WWP property had no capacity to sue and failed to state a valid cause for action.

The PUD seeks condemnation of approximately 107 miles of transmission line, 245 miles of distribution system, and the WWP water right lease at Meyers Falls power plant, producing 1,200 kw.

A hearing on a decree of necessity for the condemnation has been set for Stevens County Court Jan. 14.

A second condemnation proceeding against WWP, that of Chelan County PUD, is ready for a jury trial to determine the value of Chelan Dam and its 48,000-kw power plant. The State Supreme Court last week denied a rehearing on its plea that the Chelan PUD's certificate of public use and necessity be modified to omit the section which allows the PUD to condemn the Chelan Dam.



Two Utilities Win 'Laurels' . . .

. . . from Nurserymen's Association

Two electric companies are among the winners of "Plant America" awards. The competition is conducted by American Association of Nurseymen in recognition "of achievement in industrial landscaping and beautification contributing to employee and civic pride in our American heritage."

Consolidated Edison Co of New York, Inc, received the national "Plant America" award for landscaping of substations in residential areas. Its landscaped Douglaston substation, North Queens, N. Y. (top) shows how equipment is concealed by planting. Florida Power Corp, St. Petersburg, was given a regional "Plant America" award. Landscaped plant at bottom is Florida Power's Bayboro Plant in St. Petersburg.

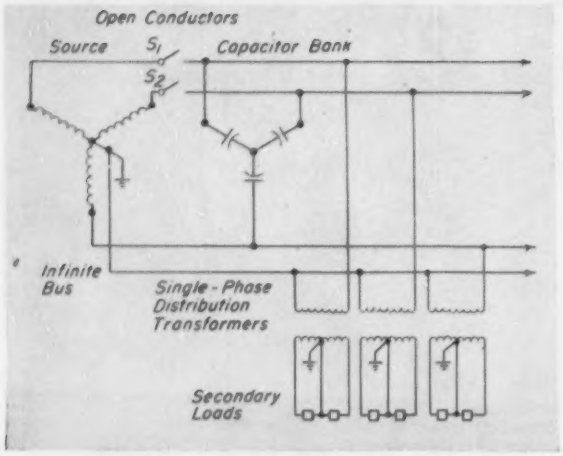


FIG 1—REPRESENTATIVE CIRCUIT under study is 4-wire multi-grounded distribution feeder which is duplicated in the next drawing

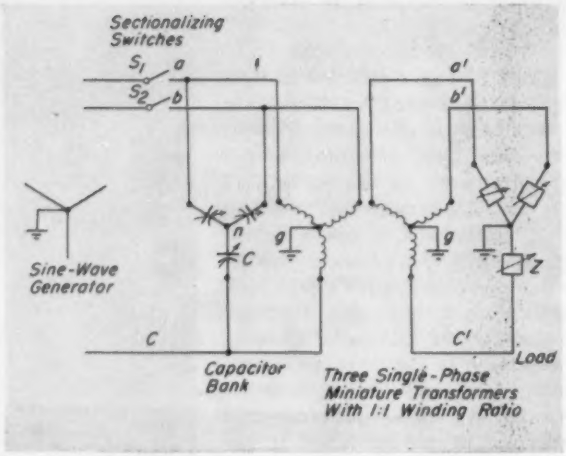


FIG 2—SYSTEM in miniature with equivalent circuit set up for the transient network analyzer. Much of study was based on this circuit

Open conductors and capacitors can produce . . .

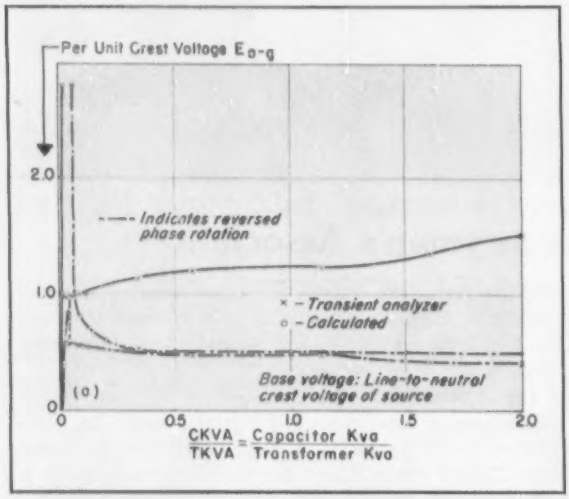
Abnormal 3-Phase Feeder Voltages

P. E. HENDRICKSON,
I. B. JOHNSON,
N. R. SCHULTZ,
General Electric Co, Schenectady 5

Several utilities have experienced damaging and destructive voltage conditions on consumer services caused by single-phase switching or broken conductors. These abnormal voltage conditions may occur as either high or low voltages, the latter often accompanied by reversed phase rotation.

Specifically, these phenomena have occurred on grounded-wye or four-wire distribution systems containing floating wye or delta-connected capacitor banks for kilovar supply, Fig. 1. Although this is perhaps the most common circuit arrangement where trouble of this nature can occur in practice, it is recognized that the same phenomena may result on many other configurations.

Study of Fig 1 will show that when one or two phase conductors are opened on the source side of the ungrounded-wye capacitor bank (or a delta-connected bank) and load com-



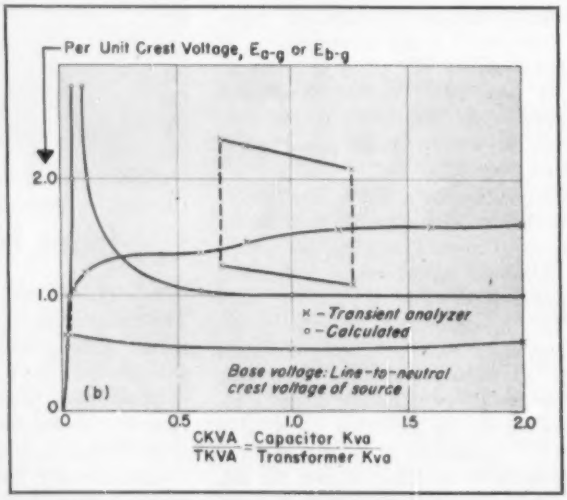


FIG 3—COMPARISON OF CALCULATED AND ANALYZER RESULTS of line-to-ground voltage on open phase at transformer primary are shown for (a) one open and (b) two open conductors. Calculated results ignore transformer saturation, analyzer results include it

bination, a 60-cycle driving voltage exists in a series L-C circuit consisting of the capacitor bank and distribution transformers in the open phases. It immediately becomes apparent that abnormal voltage conditions may be caused by series resonance.

Four Corrective Measures . . . Corrective measures that may be taken include:

1. The capacitor neutral may be solidly grounded to eliminate abnormal voltages and reversal of phase rotation.

2. Three-phase sectionalizing—disregarding conductor breakage—will tend to eliminate sustained abnormal voltages and phase reversals.

3. A resistor of less than 1 per unit (based on installed transformer kva) in the grounded capacitor neutral, will tend to eliminate ferro-non-linear oscillations but not necessarily undervoltages.

4. Grounding the capacitor neutral through a reactor requires a low value of reactance to eliminate high abnormal voltages.

If linear circuit impedances are assumed, calculations can be made which give the results shown in Figs 3a and 3b for one and two open conductors respectively for a no-load condition. Unfortunately, an analysis based on linear impedances does not yield results actually experienced because transformer saturation will introduce greatly modified and multivalued voltages. The effects of transformer saturation are illustrated in Figs 3a and 3b, these results being obtained from a study of systems in miniature on the transient network analyzer.

Transformer Saturation . . . Effect of transformer saturation had been studied previously, usually under conditions of no load. However, it seemed desirable to include the combined effect of system load and transformer non-linear magnetizing characteristics upon those abnormal voltages and as a consequence obtain a more realistic evalution of possible system behavior. The study was based essentially on the equivalent circuit shown in Fig 2 where various ratios of capacitor kva to transformer kva (Ckva/Tkva) and various values of load magnitude and power factor were investigated with one or two open phases as indicated by switches S_1 and S_2 respectively.

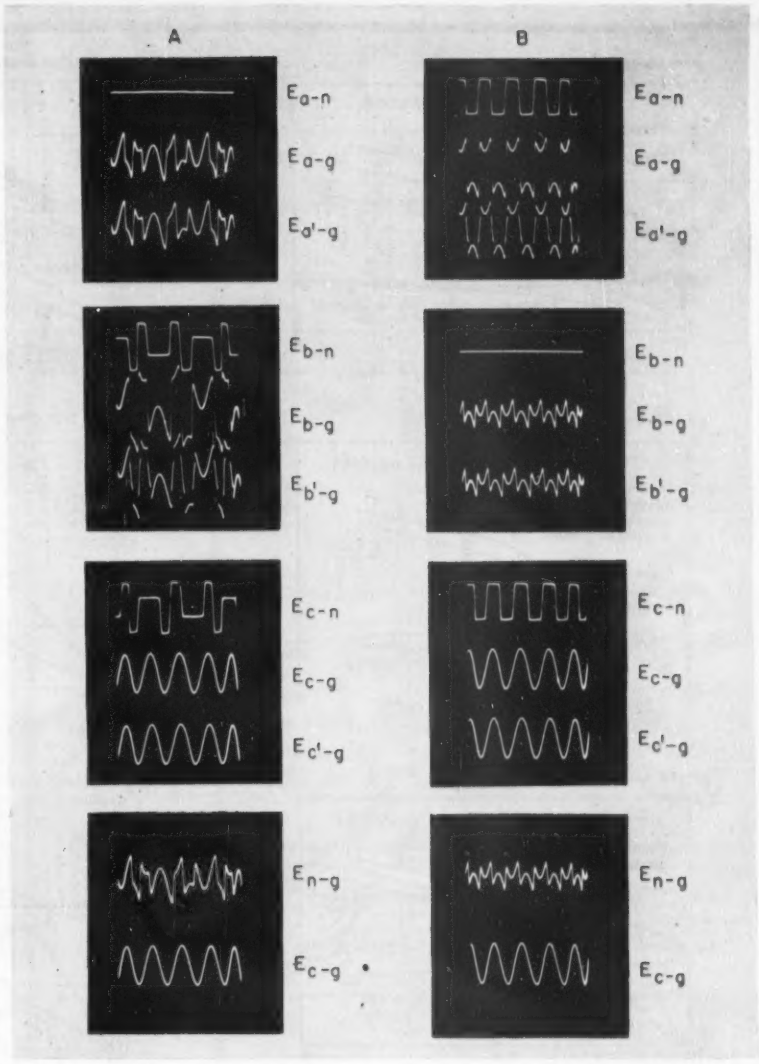


FIG 4—VOLTAGE OSCILLOGRAMS for two open conductors with S_1 and S_2 of Fig 2 open. No load on transformers. Ckva/Tkva equal 0.85. Refer to Fig 2 for identification of oscillograms. (A) One set of simultaneous voltage oscillograms. (B) Second set of simultaneous voltage oscillograms for the identical circuit conditions

Table I—One Open Conductor

Voltage Across Primary of Transformer on Open Phase

Ckva	Measured Values				Graphical Analysis		Load
Tkva	RMS	pu**	Peak	pu	RMS	pu**	pu**
3.39	2.15	0.54	1.98	0.50	2.05	0.52	0
0.85	1.55	0.54	1.36	0.52	1.47	0.56	0
3.39	2.00	0.85	1.76	0.82	1.78*	0.84*	Full Load Lagging
0.85	0.80	Single Valued	0.80	Single Valued	0.72*	Single Valued	Full Load Lagging
3.39	1.94	0.53	1.72	0.54	2.00	0.50	½ Load Resistance
3.39	0.44	Single Valued	0.44	Single Valued	0.44	Single Valued	Full Load Resistance

* Value obtained upon including leakage reactance.
** Per Unit values

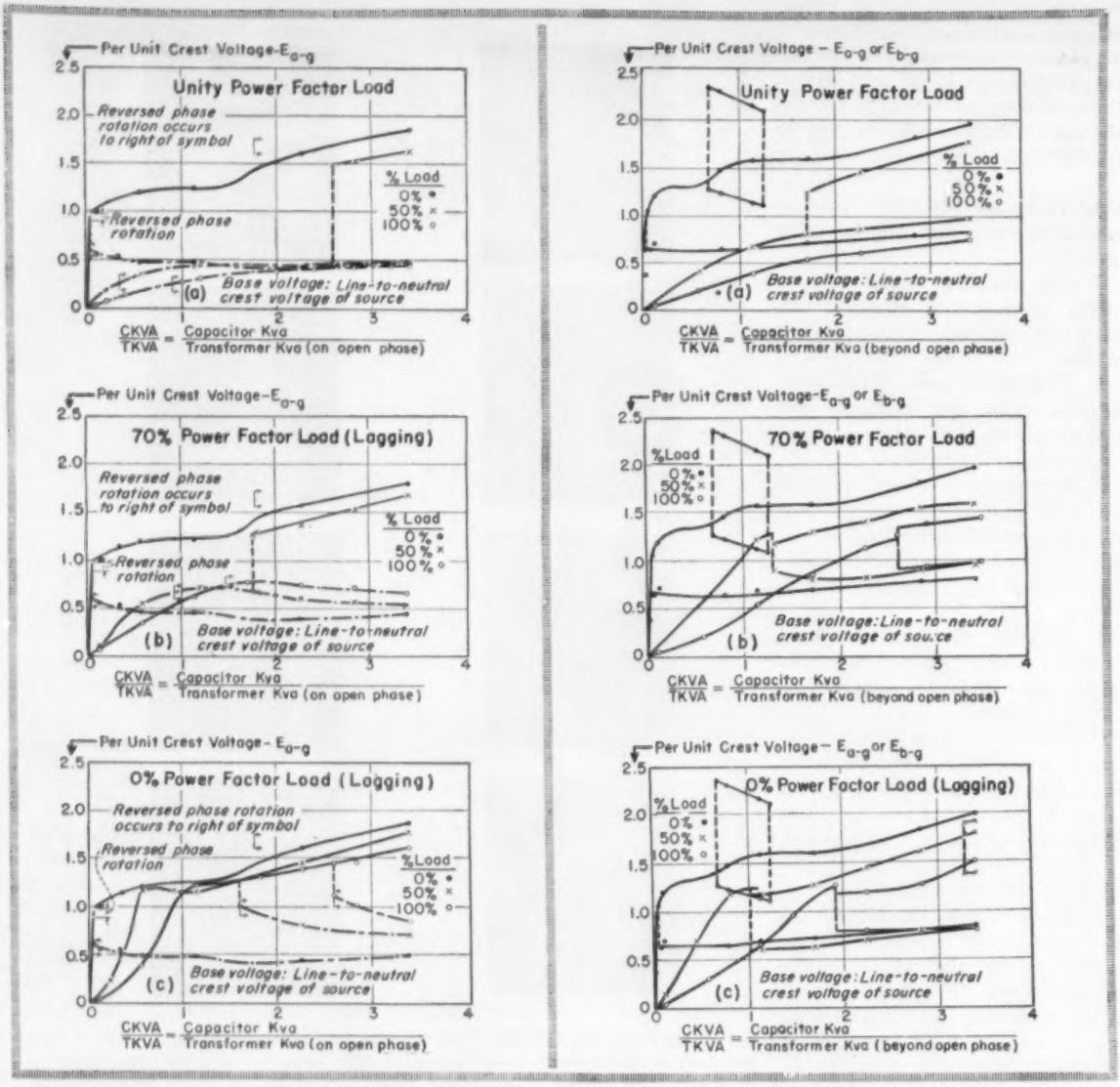

Per Unit Crest Voltage-E_{a-g}
Unity Power Factor Load
Reversed phase rotation occurs to right of symbol
Reversed phase rotation
% Load
0% •
50% ×
100% ○
(a) Base voltage: Line-to-neutral crest voltage of source
CKVA / TKVA = Capacitor Kva / Transformer Kva (on open phase)
Per Unit Crest Voltage – E_{a-g} or E_{b-g}
Unity Power Factor Load
% Load
0% •
50% ×
100% ○
(a) Base voltage: Line-to-neutral crest voltage of source
CKVA / TKVA = Capacitor Kva / Transformer Kva (beyond open phase)
Per Unit Crest Voltage-E_{a-g}
70% Power Factor Load (Lagging)
Reversed phase rotation occurs to right of symbol
Reversed phase rotation
% Load
0% •
50% ×
100% ○
(b) Base voltage: Line-to-neutral crest voltage of source
CKVA / TKVA = Capacitor Kva / Transformer Kva (on open phase)
Per Unit Crest Voltage-E_{a-g} or E_{b-g}
70% Power Factor Load
%Load
0% •
50% ×
100% ○
(b) Base voltage: Line-to-neutral crest voltage of source
CKVA / TKVA = Capacitor Kva / Transformer Kva (beyond open phase)
Per Unit Crest Voltage- E_{a-g}
0% Power Factor Load (Lagging)
Reversed phase rotation occurs to right of symbol
Reversed phase rotation
%Load
0% •
50% ×
100% ○
(c) Base voltage: Line-to-neutral crest voltage of source
CKVA / TKVA = Capacitor Kva / Transformer Kva (on open phase)
Per Unit Crest Voltage – E_{a-g} or E_{b-g}
0% Power Factor Load (Logging)
%Load
0% •
50% ×
100% ○
(c) Base voltage: Line-to-neutral crest voltage of source
CKVA / TKVA = Capacitor Kva / Transformer Kva (beyond open phase)

FIG 5—TRANSIENT ANALYZER RESULTS for one open conductor. S_1 of Fig 2 is open, and S_2 is closed. (a) Line-to-ground voltages at transformer primary on open phase. (b) Same as (a) except 70% load power factor. (c) Same as (a) except 0% lagging pf

FIG 6—TRANSIENT ANALYZER RESULTS for two open conductors. S_1 and S_2 of Fig 2 are both open. (a) Line-to-ground voltages at transformer primary on open phases. (b) Same as (a) except 70% load power factor. (c) Same as (a) except 0% load power factor

The oscillograms in Fig 4 illustrate the nature of the voltages obtained for the case of two open conductors, with no load on transformers, and a Ckva to Tkva ratio equal to 0.5.

Representative of the many conditions studied and the results obtained are Figs 5a, 5b and 5c showing the variation of transformer primary voltage on the open phases as a function of Ckva/Tkva, load power factor and percent transformer loading. A corresponding set of curves for two open conductors are shown in Figs 6a, 6b and 6c. It is to be noted that as many as four different sustained voltages were obtained at a given point on the circuit by random opening and closing of the circuit.

Graphical Approach Helpful . . . Graphical analyses involving transformer saturation produce useful concepts and results that agree closely with the data obtained from the transient network analyzer as shown in Table I for one open conductor. The methods of making the graphical solution are illustrated in Figs 7 and 8 and may be explained by first referring to Fig 7 which is an equivalent circuit of Fig 1 for the one-open-conductor case. With switches S_1 and S_2 of Fig 7 open no load condition—and assuming sinusoidal voltages and currents, the equation of the circuit voltages is:

$$E = E_C + E_L \qquad (1)$$

where $E_L \propto f(I)$ and for the conditions now being analyzed is shown as curve 2 in Fig 8. Equation (1) can be written as:

$$E_L = E + \frac{i_1}{\omega C} \qquad (2)$$

Graphically, equation (2) can be solved as shown in curves 1, 2, and 3 of Fig 8. The intersections of the capacitor line E_c' (curve 3) drawn through the applied voltage E of 50 volts (curve 1) on the ordinate may give as many as three intersections such as points a, b, and c on curve 2, and consequently, three possible answers. However, as has been shown previously, by others, point a is an unstable condition in that no sustained oscillations are obtained. Point b is a solution that results in sinusoidal voltages for E_c' and E_L, while point c is a solution that corresponds in an actual circuit to non-sinuosoidal voltages for E_c and E_L.

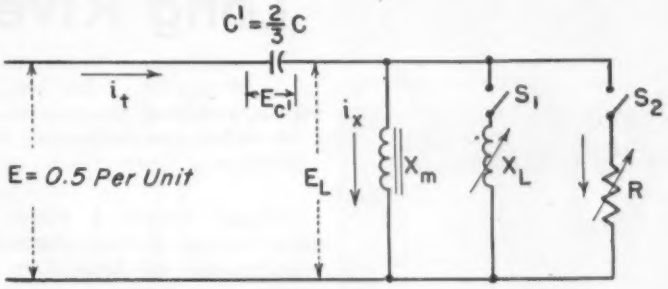


FIG 7—EQUIVALENT CIRCUIT OF FIG 2 for one open conductor as used in the graphical analyses

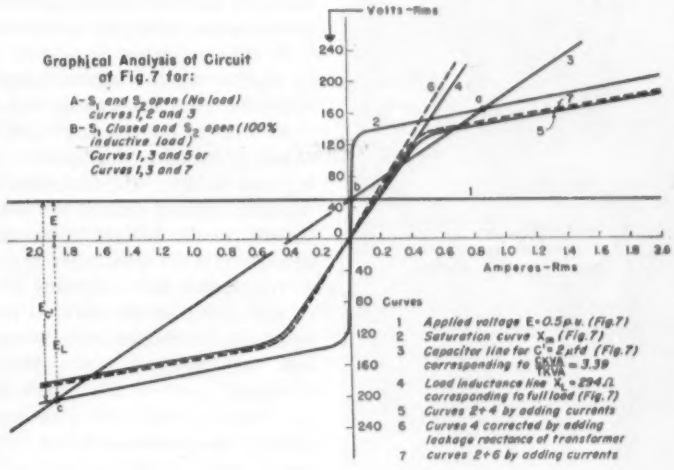

Graphical Analysis of Circuit of Fig.7 for:
A- S1 and S2 open (No load) Curves 1, 2 and 3
B- S1 Closed and S2 open (100% inductive load) Curves 1, 3 and 5 or Curves 1, 3 and 7
Volts-Rms
Amperes-Rms
E
E_C'
E_L
80 Curves
1 Applied voltage E=0.5 p.u. (Fig.7)
2 Saturation curve X_m (Fig.7)
3 Capacitor line for C'=2 μfd (Fig.7) corresponding to 3.39
4 Load inductance line X_L=294Ω corresponding to full load (Fig.7)
5 Curves 2+4 by adding currents
6 Curves 4 corrected by adding leakage reactance of transformer
7 curves 2+6 by adding currents

FIG 8—GRAPHICAL ANALYSIS of the circuit of Fig 7 for one open conductor under no-load and full inductive-load conditions

Many Conclusions Possible . . . From curves and data such as shown in Figs 5 and 6, the following conclusions were drawn:

1. Opening of one phase conductor can cause high transient voltages of relatively long duration, sustained undervoltage or overvoltage and reversal of phase rotation—all potentially serious.

2. Opening of two-phase conductors can cause, in addition to high transient voltages of relatively long duration, sustained undervoltages and/or overvoltages.

3. With two open conductors, higher abnormal voltages in general will be produced than with one open conductor.

4. For one open conductor, the high abnormal voltages are non-sinusoidal; whereas for two open conductors both the high and low abnormal voltages can be non-sinusoidal.

5. For one open conductor, the occurrence of reversal of phase rotation is associated with the lower abnormal voltage and not with the higher voltage value where two voltage conditions are possible.

6. For two open conductors, where only one value of voltage is obtainable on the open phases, the voltage is generally sinusoidal. When two or more values can be obtained, a high ferro non-linear voltage will always be obtained on one of the two open phases.

7. Unrealistic answers result if transformer saturation is neglected in a mathematical analysis of the circuit for one or two open conductors.

8. Generally, increased load, regardless of power factor, reduces the magnitude of all abnormal voltages.

9. Increased load increases the ratio of capacitor kva to transformer kva at which multi-valued voltages can be obtained on the open phase or phases.

10. Effect of higher load power factor is to increase the ratio of capacitor kva to transformer kva at which multi-valued voltages occur.

11. Graphical analyses involving transformer saturation yield useful concepts and results that agree closely with the data obtained from the transient network analyzer.

12. A delta-connected capacitor bank for several observed cases gave the same abnormal load voltages as an ungrounded floating-wye capacitor bank.

13. Solid grounding of the capacitor neutral will elminate abnormal voltages and reversal of phase rotation.

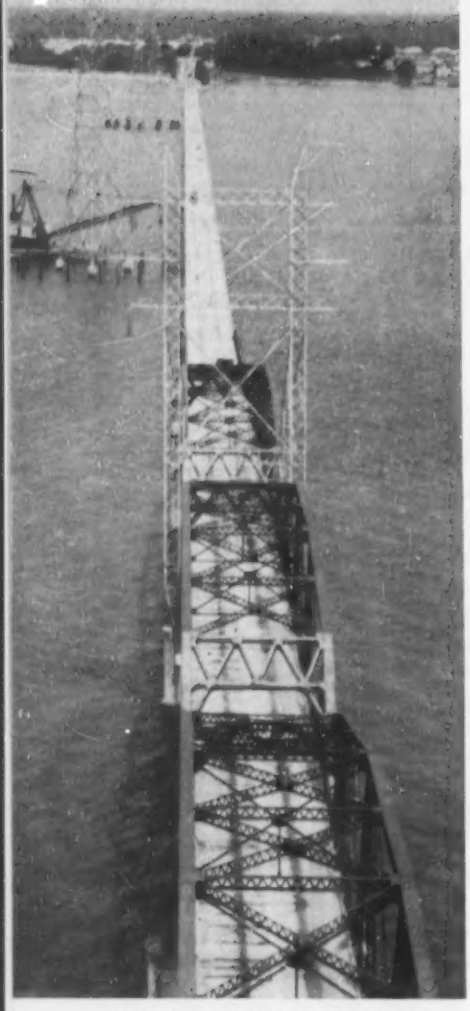
14. Disregarding conductor breakage, 3-phase sectionalizing will tend to eliminate substained abnormal voltages and reversal of phase rotation.

15. Grounding of the capacitor neutral through a resistor of a value of the order of less than one per unit, based on installed transformer kva, will tend to eliminate ferro non-linear oscillations but not necessarily undervoltages.

16. Grounding of the capacitor neutral through a reactor requires a low value of reactance for the elimination of high abnormal voltages.

Long River Crossing Has

H. W. FURLONG, Structural Engineer, Stone & Webster Service Corp, Boston, Mass.



JAMES RIVER CROSSING for 110-kv line is 4.5 miles. View is from the middle of river

Virginia Electric & Power Co's new 4.5-mile, 110-kv transmission crossing over the James River near Hampton Roads, Va., is unique among river crossings in several ways:

1. The 223-ft, 3-sided twin-circuit steel towers used in deep water sections are specially protected against impact by large ships.

2. Severe foundation conditions required use of unusual tripod-type steel-pile supports for the towers and provision of jacks for straightening.

3. H-frame wood structures, used in shallow water sections, were also protected from shipping damage.

4. Most of the crossing is adjacent to and upstream from the James River highway bridge. But four towers, in the deep channel section, are attached directly to the bridge, including two at ends of a lift span.

The James River crossing is part of a $1.5-million transmission project now under construction between Suffolk and Newport News, primarily to supply part of the power needs for Langley Field. In planning the crossing thought was given to carrying the circuits over the river in:

1. Pipe-type submarine cable.

2. Pipe-type cable attached to the bridge.

3. Bare cable supported on overhead power structures either independently or attached to the bridge.

However, as studies progressed, it became apparent that submarine cables or cables attached to the bridge would result in high installation cost, be less reliable, and make maintenance more difficult than overhead construction.

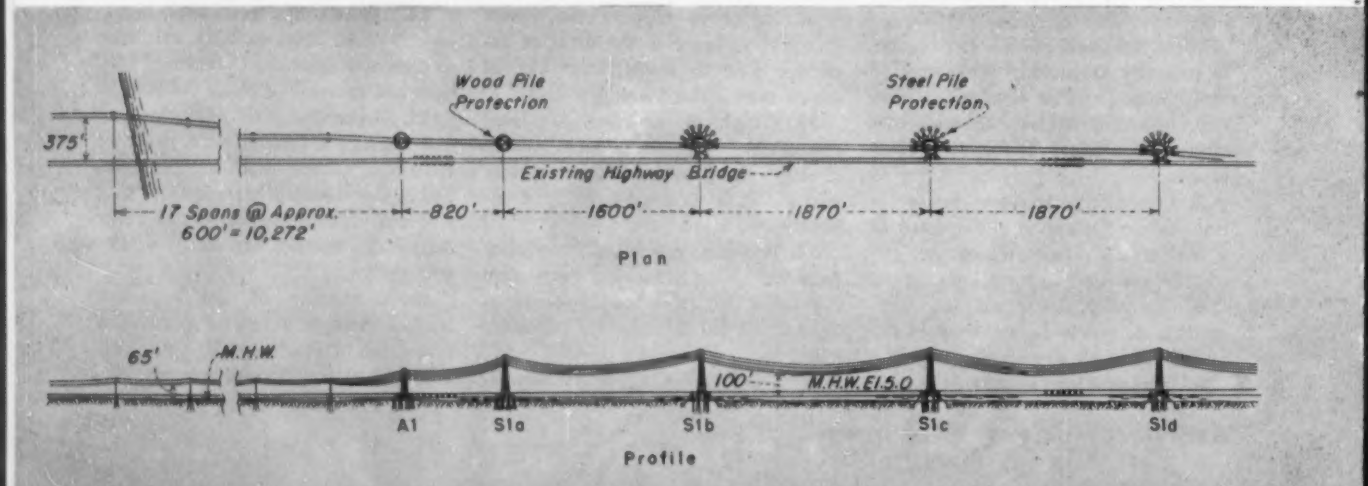
It was also decided to build the power structures independently of the bridge as this would give the power company better control of operations. However, state highway authorities and bridge engineers were most cooperative in determining the extent to which the bridge could be used.

River Crossing . . . The James River is subject to 5-ft tidal action. On the south end of the crossing minimum water depth, for about 11,000 ft, is from 2 to 8 ft. This limits navigation to small craft. To keep down cost in this shallow water section, single-circuit, fully braced wood H-frames and 600-ft spans are used. These frames are supported on heavily creosoted wood-pile foundations in tripod formation. Conductors are strung to a minimum water clearance of 65 ft to safeguard small craft operating in this zone where oyster beds prevail.

The deep-water section of the 4.5-mile crossing extends about 13,000 ft. For 9,000 ft in the middle of the river water depth is 25 to 35 ft, including the 300-ft navigation channel. The remaining 4,000 ft to the north has water depths of 10 to 15 ft.

Advantage was taken of the exist-

110-KV TRANSMISSION LINE CROSSING is adjacent to James River highway bridge near Newport News. Conductors are on wood H-frames



Novel Protection

ing through-truss construction of the highway bridge, including the lift span, to support four of the double-circuit steel towers for about 1,500 ft of the deep water section. This made it unnecessary to build independent towers, at least 300 ft high, to clear the lift span section of the bridge, which provides 145 ft water clearance. Attachment of towers to the bridge at this point saved about $500,000 in the cost of towers and expensive foundations.

For the remaining 11,500 ft of the deep-water section, double-circuit steel towers are used, built independently. Each is 222.5 ft high, above foundations and weighs about 47 tons. Tower height is governed by War Department requirement of 100 ft minimum clearance of cables above mean high water to protect numerous types of vessels navigating around the bridge.

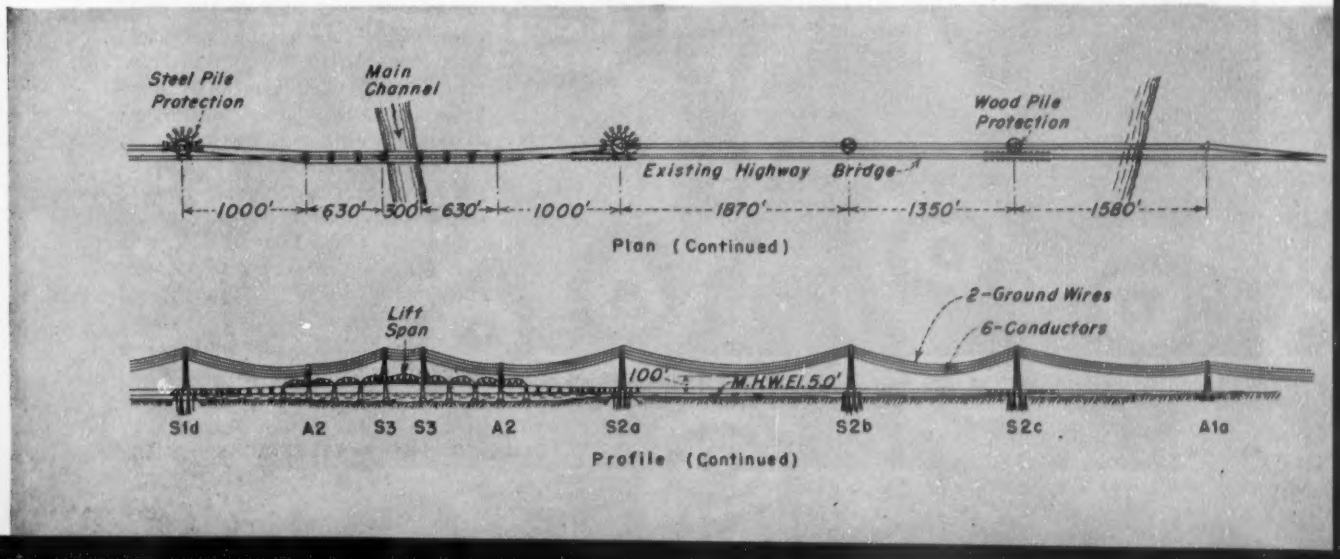
Line Design . . . Initially the crossing is being strung with a single circuit of 477,000 cir mil ACSR conductors and two 7/16-in. cw ground wires. Maximum cable tension is 7,000 lb at medium loading of ¼-in. radial ice plus 8-lb wind. Cable tension was reduced from 7,000 to 5,000 lb between the four steel towers attached to the highway bridge in order to limit additional loads imposed on the bridge trusses.

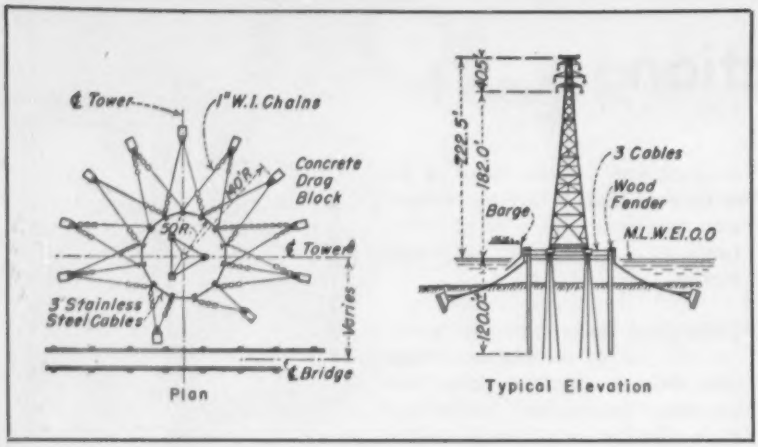
The first steel tower adjacent to wood pole structures and the north end tower are dead-end structures designed with a safety factor of 1.5 at medium loading. All intermediate steel structures have a design safety factor of 1.5 assuming two cables broken.

Three-Sided Towers . . . Steel towers not attached to the highway bridge were designed with three sides. Such three-sided towers are stiffer and more rugged than the usual 4-sided towers, without sacrificing simplicity of construction. This is believed to be particularly appropriate for the difficult deep water conditions prevailing. Should settlement occur under any one tower leg, the tripod construction will permit the tower to tilt in one plane without introducing the serious secondary stresses into the steel structure which might occur with 4-sided towers. Foundation bolts connecting the tower superstructure to the foundation mat are arranged with jacking nuts to permit adjustment and maintain the tower structure plumb regardless of possible settlement under any one of the tower legs. Each of the three tower legs consists of two angles. One of these angles is located in the plane of the adjacent tower faces. This permits low-cost tower mast assembly on land, and boom crane hoisting from a barge.

Piling . . . Tower foundations located in the deep-water zone presented a difficult problem. They called for piles up to 150 ft long in many

STEEL TOWERS near river channel are attached to bridge. Conductors clear ships for 17 spans at southwest end (left) and on eight steel towers, four with wood-pile and four, in deepest water, with steel-pile protection





THREE-SIDED STEEL TOWERS are set on concrete caps over steel piles. Each tower leg can be jacked if the footing settles. Towers are protected from impact by ships by steel piles

locations to reach stable conditions in the river bed. Tower foundations comprised three steel H-piles. Each pile consisted of 14-in., 73-lb per ft I-beams for use in deep water, and 12-in., 53 lb per ft I-beams for use in shallower water. These piles are arranged in tripod formation under each of the tower legs. At many locations these piles dropped by gravity as much as 80 ft through 35 ft of water and 45 ft of soft silt before the pile driver came into action and drove the pile into firm sand with a maximum compression load under design loading of about 40 tons.

The steel piles were capped with a concrete mat constructed above low water level. These mats support the towers. Steel cylinders filled with reinforced concrete and treated with bitumastic paint were placed around the top of each steel pile for a depth of 8.5 ft to serve as protection against salt water corrosion.

Shipping Protection . . . The individual power structures are much lighter construction than the heavy mass construction of the adjacent highway bridge. Consequently the power structures are safeguarded against serious damage in the event that heavy shipping should stray from the navigation channel or even smaller boats strike the towers.

A careful study of all the possible hazards and the great importance of having reasonable assurance that power service would not be interrupted led to a decision to construct special protective structures. These were built, as shown, around each of the four towers located in deep water. These structures consist of a ring of vertical steel piles driven around each tower. The piles are connected with three lines of circumferential stranded stainless-steel cables, each with a rated strength of over 50,000 lb, arranged to restrain various sizes of craft at all tidal conditions. Heavy wrought-iron chains with a rated strength of about 60,000 lb are attached radially to the steel piles and fastened to concrete drag blocks sunk into the river bed. Each of the drag blocks has a submerged weight of approximately 20 tons.

The drag blocks were dropped and nosed into the river bed with all chains and fastenings attached. Careful horizontal and vertical measurements determined the exact length to which the drag chain was cut so that, in the event of a collision, the steel piles would be permitted to deflect 5 or 6 ft before engaging the drag blocks. Block tops were settled about 4 ft into the river bed and are constructed to offer minimum resistance to horizontal movement, with reasonable assurance that they will yield and absorb the kinetic energy of a colliding ship.

Although the capacity of the protection structures and force required to move the drag blocks cannot be determined accurately, it is believed that the kinetic energy resulting from collision with a 1,000-ton vessel traveling at 3 knots can be safely resisted and absorbed without any damage to or contact with the towers.

Steel towers located in shallower waters are protected by encircling clusters of wooden piles. These clusters are connected circumferentially with two lines of stranded stainless steel cables, each cable having a rated strength of about 30,000 lb. These towers are much farther from the river channel, and the protection afforded is correspondingly lower in kinetic energy value than for the four main towers which are located in deep water.

The entire crossing was developed and designed by the Stone & Webster Engineering Corp under the supervision of Virginia Electric & Power Co. Steel towers were detailed and fabricated by Bethlehem Steel Co and erected by Stone & Webster which also supervised the foundation construction by the Tidewater Conctruction Corp of Norfolk.

CONCRETE DRAG BLOCKS, each weighing about 20 tons, are about to be dropped into place in the river bed. They will be attached by chain to ring of steel piles protecting a tower

Dry ice 'freezes' oil . . .

Eases Pipe-Cable Repair

Removal of a faulted section in one of Long Island Lighting Co's pipe-type cables recently proved to be a simple operation. The maintenance crew solidified the oil in a section of the cable with over 127,000 lb of dry ice and 184 gal of acetone. Then a portion of the oil was removed, and the faulted section was removed and replaced.

The problem arose when a fault developed in the 11-mile, 69-kv underground cable linking Glenwood generating station and Newbridge substation at Levittown. The cable failure occurred, presumably because of moisture, about 1,100 ft (cable distance) from the generating station.

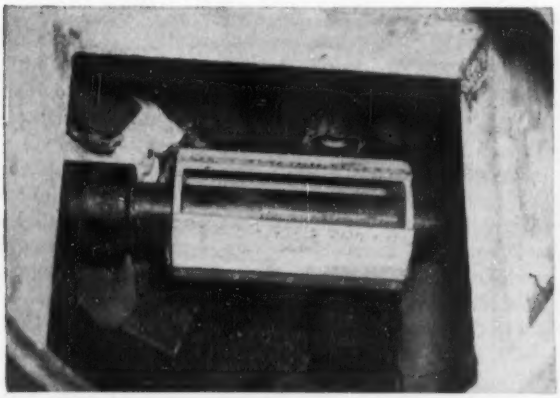
The operator had no indication of a fault when the 100-Mw generator was tripped off the line in seven cycles. But the fault-detector relay functioned and gave the clew. Also, the cable oil gauge showed a pressure rise from the normal 200 psi to 380.

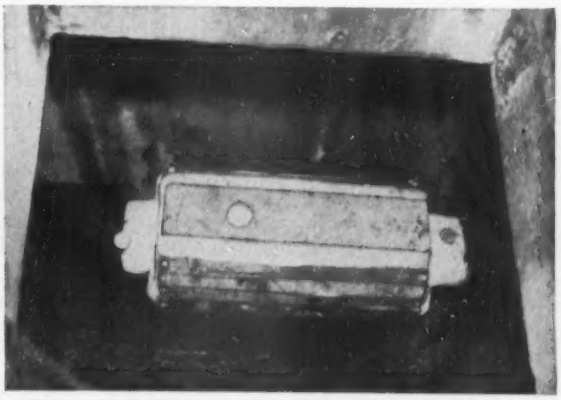
It was important to hold to a minimum the oil to be removed from the pipe so that the fault could be repaired. Such removal is both costly and time consuming. Whatever oil is removed must be reprocessed before it can be reused. The pipe from which the oil had been removed would have to be treated to remove contaminated elements.

By "freezing" a "plug" of oil on the side of the faulted section about 5,000 ft away from Glenwood Station, most of the 55,490 gal of oil in the cable could be isolated. Only 4,500 gal had to be removed.

For the freezing operation the crew opened a manhole, placed a 24-in. long cylindrical container around the pipe, and filled the container with dry ice and acetone. The mixture reduced the oil temperature to 110 F below zero, solidifying the oil. The crew could then remove the oil between the "freeze" and the Glenwood Station.

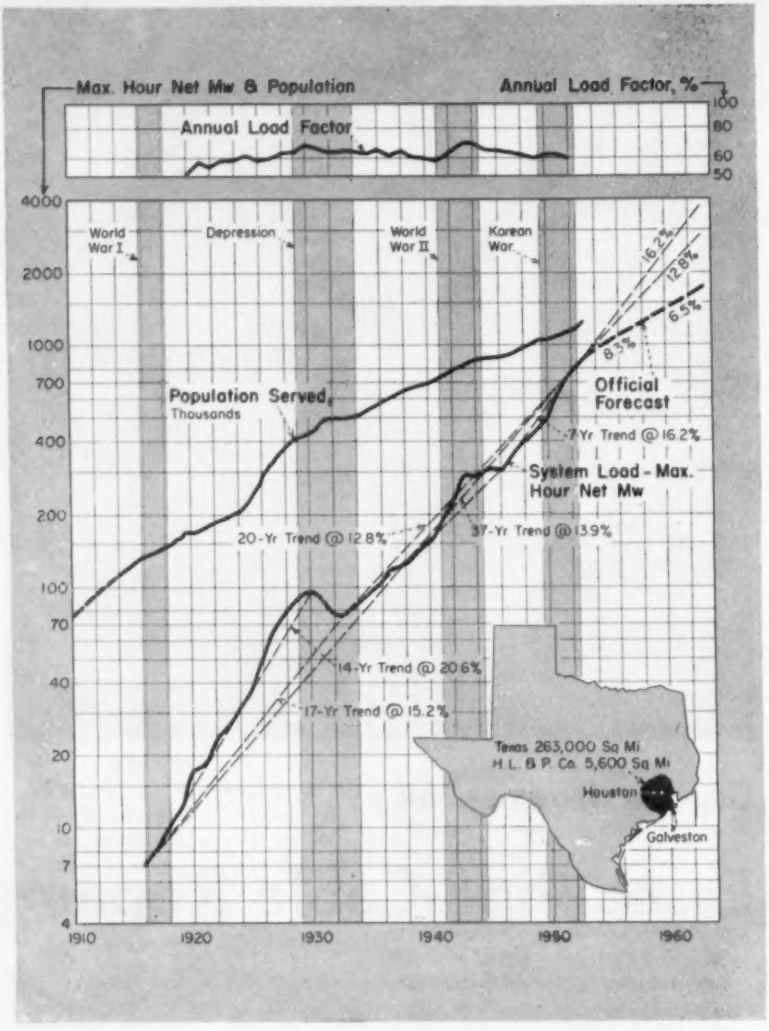
In 44 days the cable was back in service. During that time two men fed dry ice into the container 24 hours a day. In this time the cable was removed and replaced, the replacement oil was processed, the pipe and the new cable were dried, and the pipe was refilled with oil.





MANHOLE VIEW at the left shows ice container in place around the pipe, at right the container as it appeared filled with dry ice and acetone. The pipe is 6 in. dia, the container 12 in. dia and 24 in. long. Round spot at the left in the right view is a thermometer

Load up 186% since 1946 . . . . . and forecast to double again by 1963 . . . force Houston L&P to . . .



Plan System for Very Rapid Load Growth

L. K. DEL'HOMME, Supt of Engineering
and
S. L. RIEVES, General Engineer
Houston Lighting & Power Co, Houston

Tremendous load growth of postwar years has taxed the ingenuity of planning engineers and required the utmost cooperation of interconnected electric systems and industrial customers. Houston Lighting & Power Co's system load has almost trebled since 1946, setting an average annual growth rate of 16.2%. For the anticipated 860-Mw 1953 peak, Houston had 836 Mw generating capability in its own steam plants and 60 Mw of hydro contracted from Lower Colorado River Authority. But its planning objective is generating self-sufficiency.

Load growth since 1916 has averaged 13.9% per year. During the pre-depression period of 1916-1930 the rate was 20.6%. The depression period reduced it to 15.2%. But since 1932 load growth has averaged 12.8%; this is considered more representative of present day conditions.

Forecasts to 1963 . . . Official predictions of growth were 10% per year from the 492-Mw load of 1950 to 1,700 Mw in 1963. This was the average rate from 1933 to 1940. But unprecedented demands resulting from the Korean War, and knowledge of wholesale, industrial, and commercial load changes through 1956, have exceeded the earlier portion of the forecast. The remainder of the curve, 1956-1963, was obtained by arbitrarily extending it to the same 1,700 Mw value originally estimated for 1963. It indicates growth of 8.3% per year through 1956, and 6.5% from 1956 to 1963, an average of 7% for 1953-63.

System Power Supply . . . Outdoor generating stations have proved sound in the mild climate of the area. The first semi-outdoor plant was built in 1939 and the first completely outdoor plant in 1949. Today, 523 Mw of the 836-Mw system total is of the full outdoor type. And planned expansion will make 93% of system capacity outdoor or semi-outdoor by 1956.

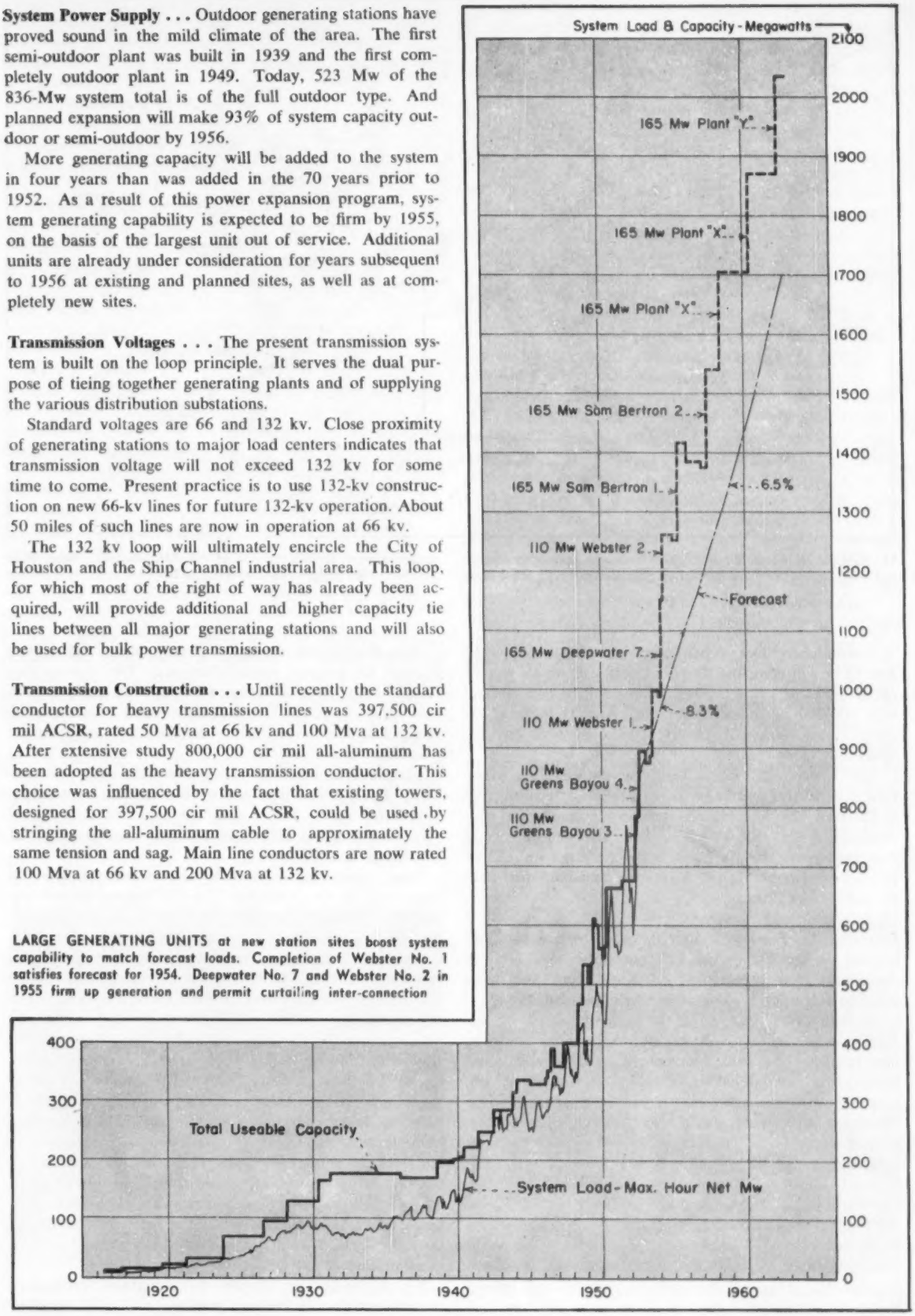
More generating capacity will be added to the system in four years than was added in the 70 years prior to 1952. As a result of this power expansion program, system generating capability is expected to be firm by 1955, on the basis of the largest unit out of service. Additional units are already under consideration for years subsequent to 1956 at existing and planned sites, as well as at completely new sites.

Transmission Voltages . . . The present transmission system is built on the loop principle. It serves the dual purpose of tieing together generating plants and of supplying the various distribution substations.

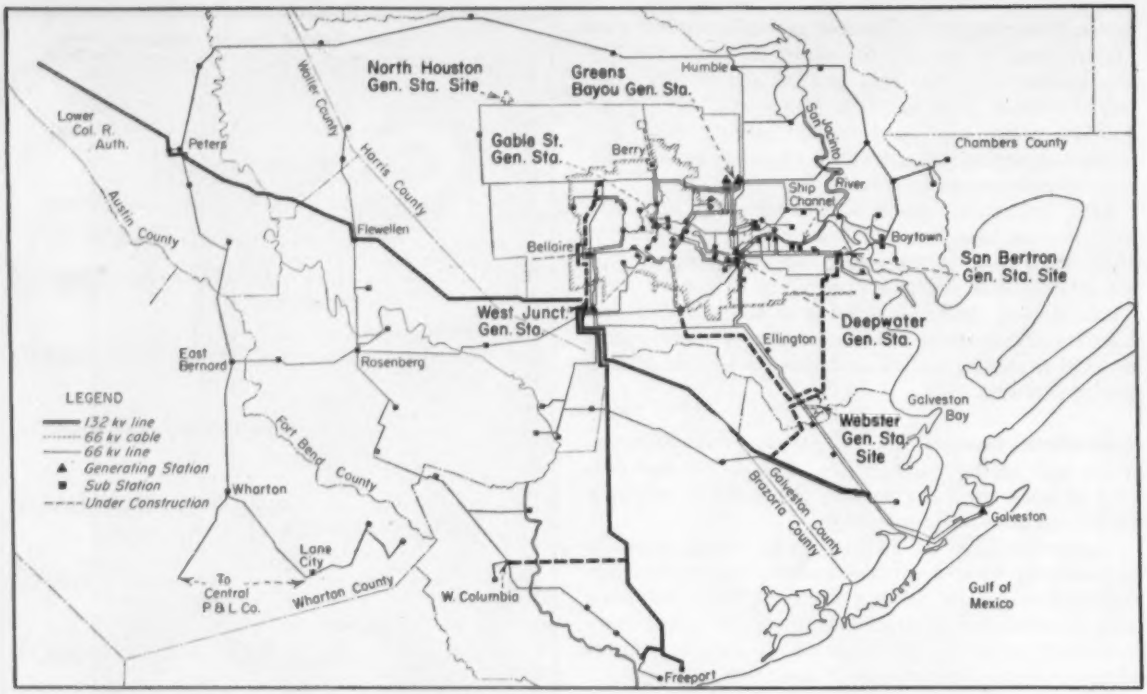
Standard voltages are 66 and 132 kv. Close proximity of generating stations to major load centers indicates that transmission voltage will not exceed 132 kv for some time to come. Present practice is to use 132-kv construction on new 66-kv lines for future 132-kv operation. About 50 miles of such lines are now in operation at 66 kv.

The 132 kv loop will ultimately encircle the City of Houston and the Ship Channel industrial area. This loop, for which most of the right of way has already been acquired, will provide additional and higher capacity tie lines between all major generating stations and will also be used for bulk power transmission.

Transmission Construction . . . Until recently the standard conductor for heavy transmission lines was 397,500 cir mil ACSR, rated 50 Mva at 66 kv and 100 Mva at 132 kv. After extensive study 800,000 cir mil all-aluminum has been adopted as the heavy transmission conductor. This choice was influenced by the fact that existing towers, designed for 397,500 cir mil ACSR, could be used by stringing the all-aluminum cable to approximately the same tension and sag. Main line conductors are now rated 100 Mva at 66 kv and 200 Mva at 132 kv.



LARGE GENERATING UNITS at new station sites boost system capability to match forecast loads. Completion of Webster No. 1 satisfies forecast for 1954. Deepwater No. 7 and Webster No. 2 in 1955 firm up generation and permit curtailing inter-connection



TRANSMISSION AT 66 KV *interconnects present generating stations and major loads. But new generating sites will supply a 132-kv loop already started around the city of Houston (shaded). Many 66-kv lines have been designed for conversion to 132 when capacity is needed*

Transmission line construction scheduled for 1953 and 1954 will complete 39 circuit miles of 66 kv and 73 circuit miles of 132 kv. Most of this will be conductored with 800,000 cir mil all-aluminum. And 31 miles of existing 66-kv lines will be re-conductored with the all-aluminum cable.

Steel towers are used in highly developed areas where land is expensive and heavy concentration of transmission is required. In undeveloped territory transmission construction is of the K-braced and knee-braced, wood H-frame type. Double plank arms are used on 132-kv H-frames. Double static wires are standard for both 66 and 132-kv lines.

Switching . . . For a year after the war, the largest circuit breaker on the system was rated at 1,500 Mva. But as the system grew, breakers of 2,500 and 3,500 Mva were installed and some 5,000-Mva breakers are planned.

As fault duties increase at the major plants, there are corresponding increases throughout the system. Thus, as new breakers of higher interrupting capacity replace existing lower rated breakers, a chain reaction is set off, resulting in pushing the smaller breakers farther out on the system. This expensive checker game has been necessary, in part at least, because manufacturers had not fully developed a 5,000-Mva 69-kv breaker until recently.

Distribution . . . The standard distribution voltage is 12 kv. All load growth is served at that voltage by converting fringe areas from 4 kv. Under this program the area served by 4-kv systems in the Houston and Galveston metropolitan areas will gradually be reduced and limited to present substation capacities.

The distribution system probably offers the system planner his greatest potential reward. Distribution represents about 50% of Houston's total plant account. For this reason, plus the fact that distribution lines serve the customers, it receives prime consideration in company planning.

Metropolitan stepdown substations have been standardized. These substations are of the outdoor, automatic, unattended type. Today nine are equipped with supervisory control, but plans call for such equipment in 62 substations by 1957.

Load forecasting is vital to distribution planning. A large part of the predicted 234-Mw system growth expected between 1953 and 1956 will be on the distribution system. Because of this, intensive examination is required to determine the growth pattern. It is essential to make load forecasts by load centers. The 112,500 kva in transformer capacity scheduled for 1954 was determined in that manner.

Revise Distribution Policy . . . Looking forward to increasing load density in urban areas and to complete development of all vacant areas, the company's 12-kv overhead planning policy has recently been revised. The new policy plans feeders and mains in advance of area development and sets up minimum conductor sizes. All 12-kv main feeder ties between major substations in incorporated towns and cities and other feeders as far as the first main branch will be conductored with at least 4/0 copper or its equivalent. This provides satisfactory voltage as well as continuity of service.

For 5,000 kva per circuit, 4/0 copper 12-kv feeders provide satisfactory voltage conditions at a distance of

about 3.7 miles. Thus new substations on the system can be located from 5 to 7 miles apart. Intermediate substations will be constructed as the original substations reach about 50% of the transformer self-cooled capacity.

Distribution voltage is regulated by individual feeder regulators on the 4 kv and by bus regulation on the 12-kv system, and by raising generating system voltages about 3% over the daily peak. Supplementary regulation is provided by switched and fixed capacitors out on the feeders.

Kilovar Supply . . . The principal sources of kilovar supply are the generators and static capacitors. There are only three synchronous condensers with a combined rating of 19,000 kvar on the system. No more are planned.

For the 1953 peak season the total capacity in fixed and switched capacitors was 360,000 kvar. A minimum reserve reactive capability of about 10% is maintained in the rotating machines for emergency conditions.

Of the 360,000 kvar about 150,000 are required to provide satisfactory voltage levels on transmission and safe generator reactive loadings. These capacitors are switched in and out of service on instructions from the dispatcher. The remaining 210,000 kvar are on the 4-kv and 12-kv distribution systems for power factor correction of new loads, such as air conditioning, which are predominantly poor power factor. Between 1946 and 1952 air-conditioning increased from 23,500 tons to 151,000 tons. In 1952 alone, over 34,500 tons were added of which 19,600 were installed in residences. Present information indicates that 1953 installations will equal or exceed 1952.

The foregoing figures do not reflect customer owned capacitors which in total represent a sizable block of kilovar capacity. Power factor correction by customers is encouraged by rate schedules based on kva demand.

At the time of the 1953 peak the system had 42 kvar in static capacitors for every 100 kw of load. More significant is the fact that for the two-year period 1951 to 1953, 85 kvar were added for every 100 kw increase in load. This relatively high ratio reflects need for an abnormally large amount of reactive supply to meet the 1952 peak requirements when 130 Mw, or 1/6 of the load, had to be imported through transmission interconnections.

Future kilovar requirements are forecast for periods of two or three years. Distribution system requirements are forecast by substations. Transmission requirements are determined by engineering studies including use of the ac network analyzer. Present plans indicate that capacitors will be added to the system at a minimum rate of 1 kvar for every 2 kw in new distribution load.

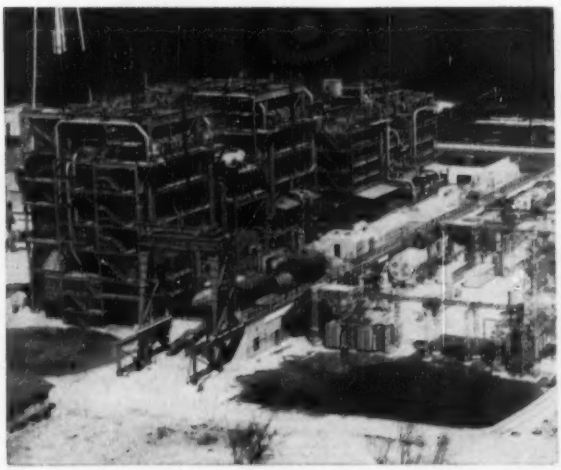
AC Network . . . Houston's principal business district is served by three 120/208-v secondary networks supplied at 12 kv, and a diminishing 4-kv radial system. This underground system serves a load of about 78 Mva concentrated in an area of ⅓ sq mile, equivalent to a load density of about 240,000 kva per sq mile.

For the larger network loads the policy has been to use 750 kva, 3-phase network transformers with 2,500-amp protectors mounted on the side. Vaults are generally located in basements of customers buildings.

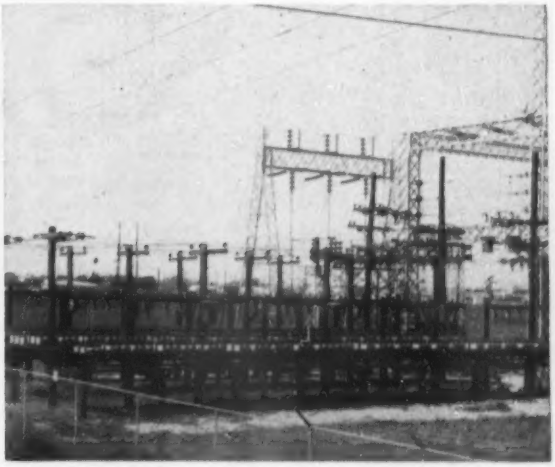
But increasing load in the downtown area from air conditioning, higher illumination, and larger buildings has created customer demand for a higher service voltage. Motors of 500 hp are not uncommon, and a few 800-hp motors are used in the secondary network area.

A new 35-story building to be constructed will have total load over 6,000 kva, including three 1,000-hp motors. The difficulties which would be encountered by the customer if served from the 120/208-v network are apparent. Accordingly, after detailed investigation and joint study with the customer's engineers, spot network service at 277/480 v will be provided. Plans are now under way for making this service available for certain other large new loads.

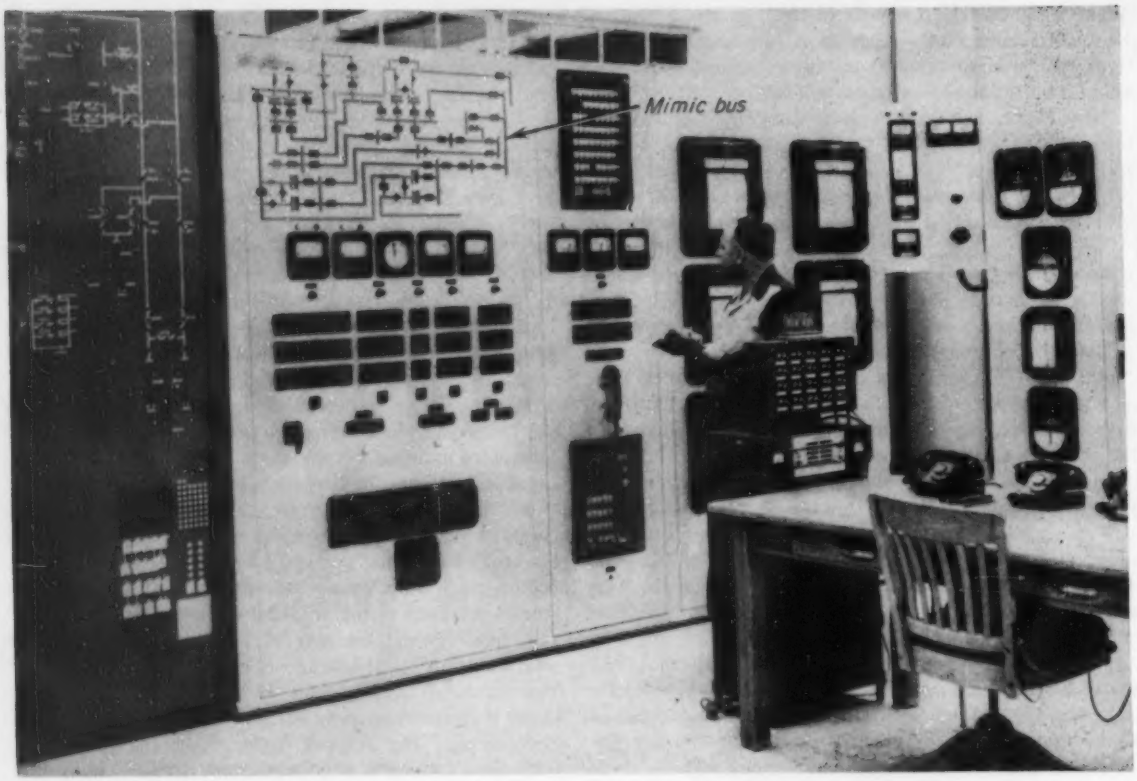
Transformer units will be 1,000 kva rated 13,200—277/480 v with four 2½% full capacity taps below normal. Network protectors will be side-mounted, and the primary cables will enter the bottom of the high-voltage chamber. High-voltage disconnect switches will be provided to eliminate working the 480-v protector hot. But these switches will not have a grounding position as grounding switches are already installed on all 12-kv network feeders—usually in the first vault served.



COMPLETELY OUTDOOR GENERATING STATIONS have proved successful and will be used as basis of the expansion program

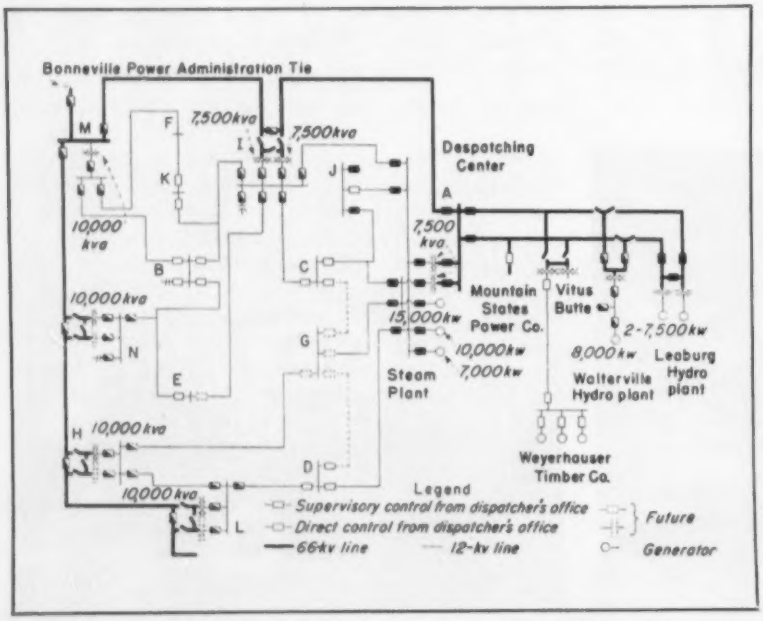


SHUNT CAPACITORS supply most of kvar requirements. Manually switched banks at substations control transmission voltage



CONTROL PANELS in dispatching center of Eugene (Ore.) Water and Electric Board house the supervisory equipment for 66/12-kv substations and a hydroelectric station. The dispatcher is checking the mimic bus to determine system conditions before planning switching

Eugene Adopts Supervisory Control



SUBTRANSMISSION and 12-kv grid are under full control of dispatcher through supervisory control system. Interchange with Northwest Power Pool may be handled easily and efficiently

JOHN I. FULLER, Electrical Engineer, Eugene Water & Electric Board, Eugene, Ore.

JAMES G. KIRWAN, Consulting and Application Engineer, Westinghouse Electric Corp, Portland, Ore.

Use of supervisory control in a new dispatching center is the key to coordination of the 66/12-kv system operated by Eugene (Ore.) Water and Electric Board. Flexibility of control on this 55,000-kw system has been achieved by locating a dispatching office at the hub of system generating facilities where an economical combination of direct, remote, and supervisory control is possible. This control is combined with appropriate communication and telemetering to centralize complete systemwide information and authority in a single dispatcher.

With complete system information and supervisory control available at

one point, a considerable number of operating advantages have been obtained by the system. The more important of these advantages follow:

1. Interchange with Northwest Power Pool through Bonneville Power Administration can be adjusted quickly for mutual benefit.

2. Reactive power flow within EWEB system and at the interchange point is easily controlled by the switching of capacitor banks at two substations.

3. Power flow to and from emergency ties with Mountain States Power Co and Weyerhaeuser Timber Co at Springfield, Ore., is now controllable by splitting EWEB system through supervisory control. This operation was not practicable before.

4. Any substation now may be energized from at least two directions.

5. Complete and efficient control of generation and power flow has resulted in operating flexibility and reduced outage time.

Dispatch from System Hub . . . The dispatching office is located in the northeast section of the city. It is adjacent to both the main 32,000-kw steam plant and terminating substation for double transmission lines from the 8,000-kw Walterville and 15,000-kw Leaburg hydro plants some miles to the east of Eugene, on the McKenzie River.

Steam generation is controlled through directly connected operating panels located in the dispatching center. Remote, automatic control of Walterville hydro station is provided through supervisory control operating over power line carrier. Leaburg hydro station is a manually controlled. base-load plant, having resident operators who are directed by telephone over the board's private communication system.

Completing the power supply picture, a 30,000-kw interconnection with Northwest Power Pool is provided by a BPA tie at substation M in the northwest corner of the 66-kv loop. Emergency tripping of the tie breaker by supervisory control and telemetering of interchange watts and vars is available to the dispatcher through equipment controlling this station.

To insure system security, flexible control of generation is augmented by control of the 66-kv subtransmission loop and 12-kv express feeder grid. Loss of service resulting from emergencies or switching for maintenance and repair operations is minimized by supervisory control of five major substations. By centralizing control of breakers in the 66-kv loop and 12-kv express feeder grid, arrangement of the system is at the immediate command of the load dispatcher. Service to a given station can be shifted quickly from one source to another as necessary. By coordinating relaying in express feeder grid, service also can be maintained at stations not directly under supervisory control.

Mimic Bus Aids Dispatcher . . . Switching operations and system troubles as they develop are pictured on a mimic-bus diagram of the high voltage loop and express feeder grid. Diagram is provided on dispatching office supervisory control panel. Indicating lights represent all breakers under supervisory control as well as those substation breakers near the steam plant. These breakers are controlled through multiple-conductor cables.

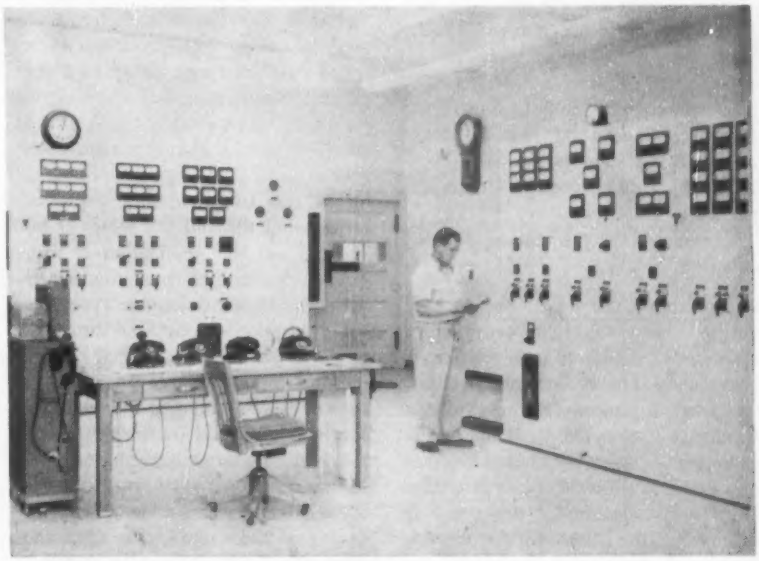
During restoration of service, a step-by-step picture presented on mimic-bus permits the dispatcher to split the system as required by available generation and to reconnect it as conditions allow.

Station Typifies Supervisory Control . . . Illustrative of five substations under supervisory control is Station M. It is located in an industrial area about five miles northwest of the steam plant. In addition to a BPA tie which is tripped and supervised only, two 66-kv breakers in the high voltage loop are under full supervision and control. Supervision and control also are provided for a 10,000-kva transformer and two feeder breakers in the 12-kv grid.

At Station M, selective zero-center telemetering of watts and vars is provided for two 66-kv loop breakers and 12-kv transformer breaker. Continuous telemetering of interchange power through the BPA tie, as well as bus voltage and synchronoscope potential, is transmitted to dispatching office. Information is carried over separate wires on the same cable as that handling supervisory control.

Selective telemetering from six locations throughout system is provided on the dispatching panel by supervisory control equipment. By selecting one telemetering point, dispatcher can determine power or reactive flow from receiving instruments mounted below mimic-bus diagram. A total of 21 telemetering readings are provided with provision for 10 additional points in the near future.

A point is provided at each substation for supervision of station alarms which will be collected as a single alarm by annunciaters in the stations. Alarms are transmitted over supervisory control equipment to alarm and indicating lights on dispatcher's panel that identify station sending an alarm.



GENERATION CONTROLS and relay panel (left) control operation of local steam plant from the dispatching center. Control, and relay panels (right) are for breakers at the center

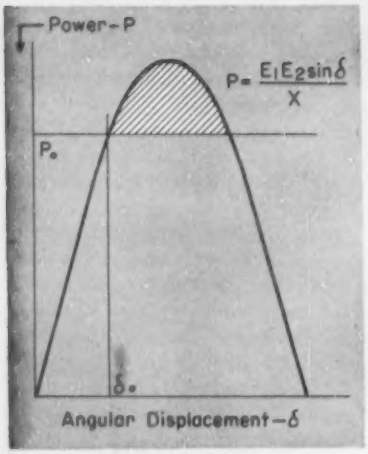


FIG 1—SINE CURVE shows basic relationship for steady-state and transient conditions

System Stability Needs Constant Attention

Six modern trends make it important for designers to keep abreast of ever-changing problems of system stability

C. H. HOFFMAN, Senior Engineer, Electric Distribution Dept, Public Service Electric & Gas Co, Newark, N. J.

System stability is still a problem in spite of recent technical progress. It remains a problem today because of several trends that are taking place in system operation and design.

1. Generators are operating at higher power factors.
2. Transmission facilities are carrying heavier loads.
3. Circuit-breaker duty is reactance limited.
4. Forced cooling of equipment is adding reactance.
5. Generation is farther from the load.
6. The change in system reactance from normal to fault-cleared conditions is being increased by other design economies.

These trends are making steady-state and transient stability of increasing interest and significance. The techniques of analyzing these problems are widely understood. And the means of improving stability are available—at a price that depends upon the particular situation.

Consider the familiar stability equation:

$$P = \frac{E_1 \, E_2 \sin \delta}{X}$$

This equation, plotted in Fig 1, covers both steady-state and transient stability relations if proper internal voltages E_1 and E_2 are used with the corresponding values of system reactance X. Today's trends in system design affect every element of this equation and point the need for continuing studies of transient and steady-state stability problems.

Lower E Trends . . . Operation of generators at higher power factor reduces their internal voltages. When E_1 or E_2 is smaller, the peak of the sine curve in Fig 1 is lowered. Unless the power transferred, P_o, is reduced, both steady-state and transient stability margins are decreased. The steady-state margin is the difference between the maximum amplitude of the sine curve and the P_o line. For transient stability the margin is related to the size of the shaded area.

Today, increasing amounts of kilovar capacity installed near the load tend to make generators operate at higher power factors. This kilovar capacity is usually in the form of switched and unswitched capacitors. Switched capacitors are frequently used to reduce voltage variations between light-load and heavy-load conditions. Sometimes they are designed to be in service only to maintain adequate service during system emergencies.

The role of unswitched capacitors in reducing I^2R and I^2X losses is well known, and the application is widespread. Sometimes capacitors are installed in the distribution system or at a substation to postpone an investment in additional facilities. Frequently these "temporary" installations become permanent even after the postponed facilities are finally installed because collateral benefits are important.

Every kilovar carried by a capacitor near the load represents somewhat more than a kilovar not carried by a generator. While this is an economic trend on an overall basis, it tends to increase stability problems. Kilowatt loadings are high for many hours in the day. During light load periods, system kilovars can be low enough to cause concern.

Larger δ_o Trends . . . Heavier loading of transmission facilities means that P_o of Fig 1 is relatively higher, requiring a larger angle, δ_o, between the internal voltages. This has the same effect in reducing stability margins as is experienced with lower voltages.

The trend toward heavier loading of facilities is widespread. In recent years it has been accelerated by the high cost of new facilities. Existing transmission lines are loaded heavily to postpone building new ones. The cost of a new single-circuit 132-kv line in some areas is as much as $70,000 a mile including right-of-way. In other localities transmission circuits are forced underground at a cost of approximately $250,000 a mile.

To meet this challenge, some metropolitan systems are loading 132-kv lines up to 100 Mw normally. This is over twice the surge-impedance rating. Such designs produce emergency loadings of about 150 Mw which is more than three times surge-impedance values. It is possible to design an adequate bulk-power transmission system of this type so that some lines are loaded to thermal ratings under emergency conditions.

As there seems to be no limit in the upward trend of transmission costs,

heavier loadings are economic. Newer lines are often built with larger conductors to increase thermal ratings. In these ways, voltage-drop and current limitations are being pushed beyond existing stability limits. This requires attention in order that stability limits can also be increased.

Larger X Trends . . . Since system reactance, X, is in the denominator of the stability equation, any increase in this factor tends to reduce the stability limit. Although new lines associated with new generators usually reduce reactance between machines, designers sometimes introduce extra reactance here in order to limit short-circuit currents. This can be done in several ways.

One such way, Fig 2, is to operate some buses in two sections instead of having them connected solidly together. Another way, Fig 3, is based on the principle of not connecting all lines of a backbone transmission system to every bus along the backbone. This skip-stop design is effective in limiting the interrupting duty of circuit breakers.

A third way of adding reactance is by means of center-tapped reactors, shown in Fig 4. Such reactors are used to limit duty on generator breakers as they present relatively low reactance values between the generator and the load buses if loadings are balanced. But they limit short-circuit current flowing between load buses. When transmission outage conditions produce a complete unbalance in flow between the two ends of the reactor, its effect on total system reactance may be important.

Even if it is not desired to introduce additional reactance, there are trends in system design which tend to bring this about. One is the increased use of forced cooling of transformers, with the accompanying increase of reactance based on transformer rating. Forced-cooled transformers have been employed frequently because they cost less than self-cooled transformers of the same rating.

Another development which adds reactance between generation and load results from the difficulty of obtaining good locations for generating stations close to load centers. Economic evolution has been to use nearby station locations first. For some systems all of these desirable sites have already been utilized; so new stations must

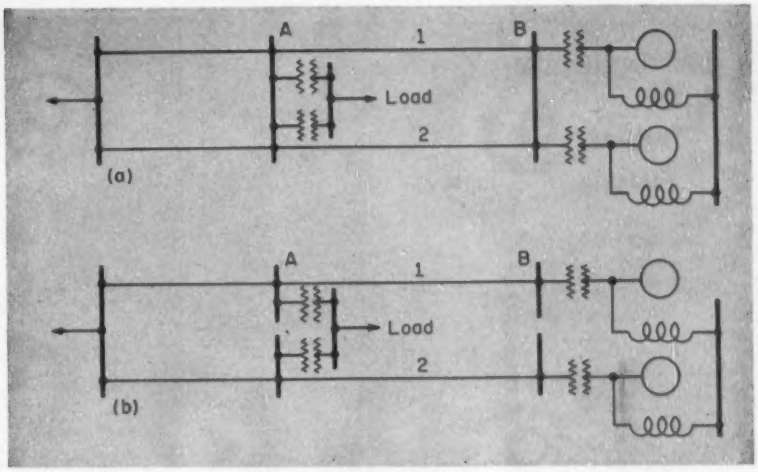


FIG 2—BUS OPERATED in two sections. In (a) loss of line 1 between A and B throws entire load on line 2. For arrangement (b) alternate path via line 2 includes double transformation

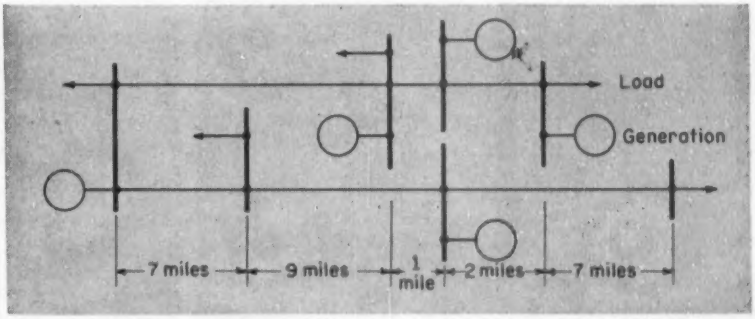


FIG 3—SKIP-STOP DESIGN reduces number of circuit-breaker positions but also increase ΔX

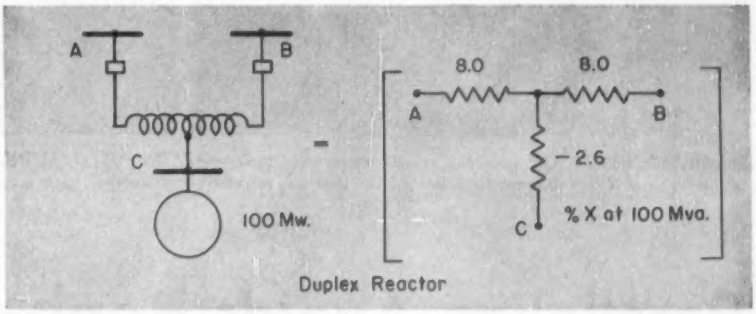


FIG 4—DUPLEX REACTORS limit duty of generator breakers and add system reactance

be farther away, geographically and electrically. This applies to steam as well as hydro systems.

The trend in generator design also tends to increase stability problems. The new inter-cooled and liquid-cooled machines are expected to have transient reactances about twice the values for conventional machines of the same rating. Lower short-circuit ratios have been advocated as a means of reducing generator costs. The lower short-circuit ratios are equivalent to an increase in generator reactance in the steady-state stability equation. Although this effect can be compensated for in the selection of the voltage regulator, the fact remains that lower short-circuit ratio requires increased attention to the stability problem.

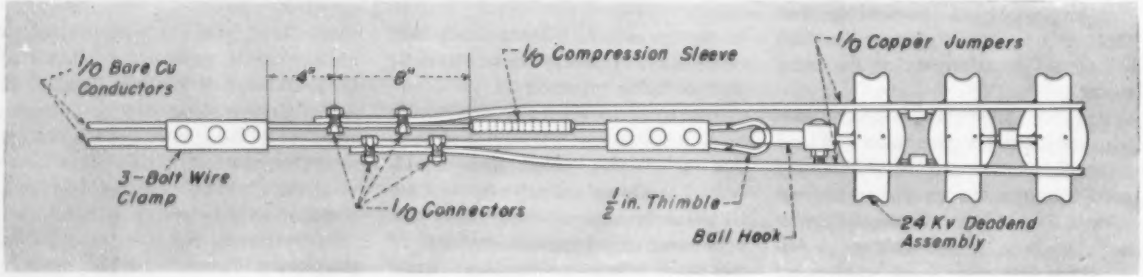
Larger ΔX Trends . . . The increase in reactance, ΔX, from normal to

(*Continued on page* 153)

ON PIN-TYPE INSULATORS paralleled conductors installed by Detroit Edison Co on a 24-kv subtransmission line appear neat and attractive

ON POST-TYPE INSULATORS paralleled conductors appear equally attractive. Conductor was 1/0 copper salvaged from old line

Paralleling Avoids Replacing Wires



DEADENDS OF PARALLEL CONDUCTORS are only little more complicated than those commonly used for single conductors. Detroit Edison reported the addition of the second conductor was accomplished with no more difficulty than the construction of any similar power line

DAVID BURNS, Distribution and Line Standards Engineer, Detroit Edison Co, Detroit, Mich.

Experience of Detroit Edison Co in paralleling conductors on a subtransmission indicates that this may be a satisfactory method for increasing the capacity of many similar lines. The practice has been fairly well established in Europe, and its pros and cons have been discussed frequently in this country.

Detroit Edison was brought face to face with the problem in 1951. The capacity of one of its 24-kv subtransmission lines had to be increased. The circuit involved was a tie line approximately 3 miles long. Conductors of 1/0, 7-strand, bare, hard-drawn copper were on the top arm position on the pole. Part of the line was built with pin insulators, part with line posts.

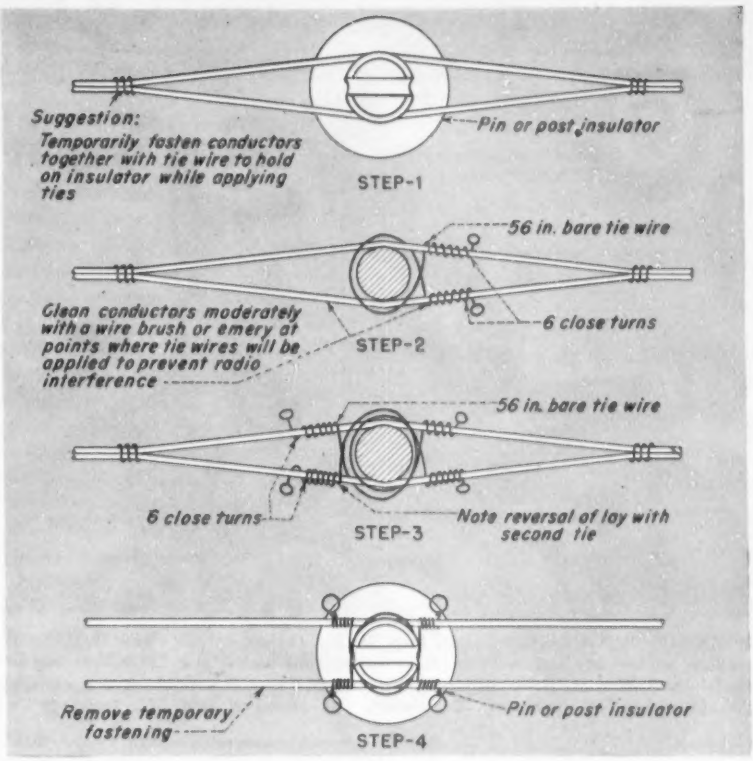
Comparison of Costs Made . . . New load required replacing the 1/0 copper with 4/0 or 250,000 cir mil, or 477,000 cir mil ACSR, the nearest size bare aluminum in stock. Metal restrictions at that time, however, made it desirable to use salvage material. Some 1/0 bare copper was available which had been salvaged from substransmission lines. Therefore, a comparison was made of the costs of paralleling the 1/0 or replacing them with either of the larger conductors. Conparative costs for the 3-mile of the three alternatives are shown in the table.

These comparisons plus the need to conserve metal resulted in installation of the additional 1/0 copper conductor per phase. Construction details are shown in the drawings.

Engineering Here Was Simple . . . Spacing between conductors is 5 in. center to center. Magnetic forces, unequal ice loading, or conductor impact are not considered serious problems with the spans and sags on this line; so no midspan spacers were used.

It is realized that the engineering problems involved in this line were simple compared to a similar problem for a high voltage tower line. Yet there may be considerable opportunity for greater use of this type of construction.

Each case would need to be considered individually. Some considerations that might influence the decision to used paired conductors are: Inability to obtain early delivery of a larger conductor; surplus of salvaged smaller conductors in stock; temporary need for higher current capacity pending construction of other facilities; convenience of using conductor size for which fittings and tools are in stock.


Suggestion:
Temporarily fasten conductors together with tie wire to hold on insulator while applying ties
Pin or post insulator
STEP-1
56 in. bare tie wire
6 close turns
Clean conductors moderately with a wire brush or emery at points where tie wires will be applied to prevent radio interference
STEP-2
56 in. bare tie wire
6 close turns
Note reversal of lay with second tie
STEP-3
Remove temporary fastening
Pin or post insulator
STEP-4

FOUR STEPS make attachment of parallel conductors to insulators a simple process. Drawings give the details. Both pin and post-type insulators were used. Wire was 1/0 copper

Cost Comparison of Three Alternatives

	Add a 1/0 Cu Wire	Replace one 1/0 with one 4/0 Cu	Replace one 1/0 with 477,000 cir mil ACSR
Ampere Capacity (D.E. Co. Rating)	600	480	600
Conductor investment	$5,750*	$10,900	$ 9,500
Labor and overhead	$6,000**	$ 9,250	$ 9,500
Annual charges at 15%	$1,760	$ 3,025	$ 2,850
Annual losses	$8,200	$ 8,200	$ 7,600
Total Annual Cost	$9,960	$11,225	$10,450

Notes:

* Salvaged 1/0 copper priced at amount for which it would have been sold if alternate construction was used.

** Two-thirds of the line had primary distribution on the poles. These circuits were left hot during construction. The labor cost to add a conductor was estimated at two-thirds that required for replacement. This is not in agreement with the last paragraph of Colby's article in July 27, 1953 issue of Electrical World, but it is thought that his conclusions are based on different conditions.

The same rate for annual charge was used for all three alternatives, however it could be reasoned that taxes would be less on the written down value of the existing 1/0 conductor, and that amortization would be higher on ACSR because of its final low scrap value compared to copper.

WORKSHOP SIMPLIFICATION CLINIC hears Roy Rix, in charge of CEI's work simplification program, explain make-up of "E. Z. Dosit" (pronounced "duz-it"), a CEI devised cartoon figure. Each letter of "Dosit" stands for one of symbols used in work chart. For example, "D" for delay, "O", operation, "S", storage, "I", inspection, and "T", transportation.

CEI Work Simplification Clinic

Cleveland Electric Illuminating outlines its program to 15 companies from Lake Erie area at recent conference

First "Lake Erie Work Simplification Clinic" was held last month in Cleveland under the sponsorship of Cleveland Electric Illuminating Co.

CEI, first utility company to install a complete work simplification program, invited several companies with similar programs to participate in the conference. Fifteen, including Detroit Edison Co, accepted. Purpose of the clinic was to exchange ideas on mutual problems in work simplification.

Presiding over the meeting were Roy Rix, general supervisor of work methods for CEI, and J. Don Healy, supervisor of work simplification.

Since CEI's program for work simplification is more comprehensive than those of the other companies attending the clinic, major portion of the discussion centered around the utility's program.

Started in 1951 . . . CEI's program was started in 1951 when several of the utility's employees on the management level began to study work simplification methods. In 1952, the program was broadened to include non-unit (non-union) office help and last year it was brought down to the union level. By the end of last year, 1,465 people of all classifications had received a regular course in the techniques of work simplification. Another 1,000 will receive this training in 1954. And by 1957 it is expected everybody in the company will have received an education in work simplification.

Rix cited these facts as evidence of the program's value to CEI: Since 1951, the company has greatly increased its power services, yet employment figures have actually been reduced from slightly above 5,000 to about 4,900. CEI estimates that by 1962 the company will have doubled its current kwhr output, with only a small percentage of increase in employees.

High Acceptance . . . Rix said that out of a total of 4,427 work change proposals received up to the end of November, 1953, 92% had been acted on and 8% are still pending. Of the 4,051 acted on, 84% have been accepted and 16% rejected.

Participants at the clinic questioned Rix on why CEI's program is so effective when employees are not given any money reward for their work simplification suggestions as is the practice in other companies.

CEI has two ways of approaching this problem, Rix explained. First, he said, the employee is given publicity for his suggestion efforts through "Work Simplification News" published monthly by CEI and through CEICo Motor, regular company house organ. Second, employees are told that a copy of each work change proposal submitted will be placed in their personnel records which are consulted when promotions are made.

Unions Back Program . . . It was pointed out at the meeting that labor unions are going along with CEI's program and even encouraging it. Labor endorses the program, it was said, because it allows the worker to use his own new ideas on the job and workers have CEI's assurance they aren't going to simplify themselves out of a job. When necessity for a certain operation is eliminated the cutback is effected through normal turnover in personnel.

According to Rix, CEI is getting ready to launch the third phase of its work simplification program, the so-called project phase. (First phase, indoctrination; second, individual scattered effort). Project phase will consist of a group or department attack on a single problem of sizable dimensions affecting that one department. Rix feels company will get more productive results from this method once everyone in the group has gone through work simplification training.

Index Is Available

Electrical World's semi-annual index for July-December 1953 has been prepared and copies are now available upon request. They may be obtained without charge. Address requests to Electrical World, Editorial Office, 330 W. 42nd St., New York 36, N. Y.

WASHINGTON COMMENT

JESSE MOCK

The session of Congress which convened in Washington last week faces a formidable stack of proposed legislation affecting electric utility operations.

While these measures must take second place to legislation of a broader, general nature, it is a good guess that the present Congress will devote more time and thought to power matters than any Congress in recent years.

Power Problems Are Plentiful For '54 Congress

Power policy of the Eisenhower Administration, much of it announced since Congress adjourned last August, will come under the careful scrutiny of vote-conscious lawmakers. Hearings already in progress in both houses indicate that Republican legislators are not unanimously supporting White House moves in the power field.

May Be Noisy Issue . . . Once New and Fair Deal Democrats team up with dissident Republicans, the power issue could blossom into a noisy, troublesome problem for Congressional leaders. Efforts are sure to be made to turn it into an issue in next year's Congressional elections.

Appropriation bills will further implement the White House power policy, and may offer a number of controversial points in the power battle as it shapes up. President Eisenhower's budget, to be presented to Congress later this month, should be the tipoff on whether the administration will back new starts for Reclamation power projects. Likewise it will show how the Administration feels about further power expansion by Tennessee Valley Authority and transmission line construction by the other agencies.

No matter which way the budget points, it is almost certain to set off a barrage of criticism in Congress. And the lawmakers will be vying with each other for newspaper space as they race toward an election-year adjournment.

One Big Bill . . . An omnibus Rivers and Harbors and Flood Control Bill is scheduled for passage. This will offer an opportunity to clarify Congressional intentions on the development and marketing of power from federal projects. It was the 1944 Flood Control Bill that extended the preference clause to Army Corps of Engineers projects and set up other marketing criteria for sale of power from these projects.

Having already passed the House by a comfortable margin, the bill which would permit five New York electric companies to develop another 1.1 million kw of power at Niagara again faces Senate consideration. In the absence of unexpected developments, this bill has a tough road ahead. Some observers believe it may end in a House-Senate deadlock as the session draws to a close.

Also before Congress this session are proposed revisions in the Atomic Energy Act to permit industry to own fissionable material and operate reactors for the production of electric power from nuclear sources. Despite strong White House support for these changes, Congress will have trouble finding a space in its busy schedule to consider them.

If such changes are made during the session, it will be as much for international effect as for domestic progress.

One or two changes of particular interest to electric utilities may come up when the House gets down to work on a tax bill. One proposed amendment would exempt a small amount of corporation dividends from individual income tax returns. Another proposes levying a tax on power revenues of public bodies in the power business. These are only two of several hundred changes proposed in present tax statutes.

Of significance is a relatively small bill which would permit the federal government to finance some of the non-reimbursible features of the Markham Ferry Dam in Oklahoma, which would be constructed by a state agency. This measure has already been passed by the Senate and now awaits House action. It could pave the way for the kind of federal-local financing of power projects being discussed by large electric companies in the Pacific Northwest.

All in all, Congress has one of the tightest schedules it has faced in recent years. Power issues are certain to get plenty of attention, but they will be in competition with other and more pressing measures.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Electronic equipment failure is predictable in advance by a device that identifies deteriorated stages or components.

Drivers with poor highway records should be questioned well before engagement in utility job where safety attitude is important.

Lead cable sheath is probably a more permanent moisture proof covering than most non-metallic sheath materials despite their resistance to weathering or to rot and deterioration in wet locations.

High-voltage river crossings and lines in proximity to airfields can be lighted by aviation warning lights which have 50,000-hour life.

Reheat turbines require less auxiliary power largely because lower steam consumption reduces the power requirements of the boiler feed pump.

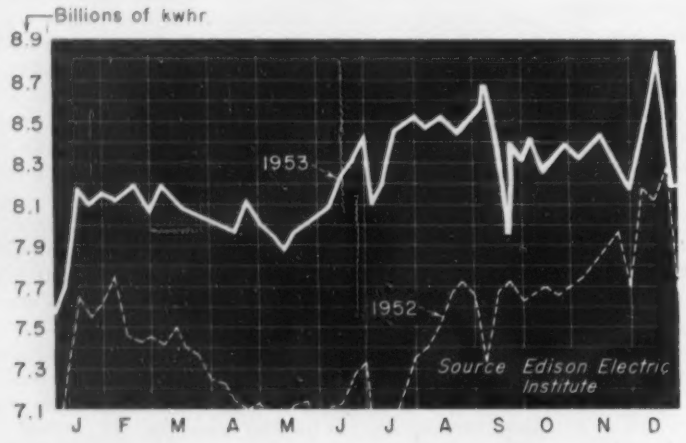
High deflection rate for a thermostat will result if one bimetal strip is 72% manganese, 18% copper and 10% nickel and the other is 36% nickel-iron alloy.

Production of goods has been the goal of industry in the last decade. Present goal should be to produce engineers to produce the next round of goods.

Company airplanes (9,500 of them) for employee transport, travel more flying hours per year than the commercial airlines' combined total.

Volt-time characteristics of extra high-voltage insulation are such as to favor reduced BIL of costly station equipment since long and multiple taps reduce severity of incoming surges.

STATISTICS



Output Week Ended Jan. 2—8,200,000,000* Kwhr

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West. Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Jan. 2	+6.3*	Not Available								
Dec. 26	+8.3	+5.0	+3.3	+0.7	+8.2	+22.5	+2.5	+8.1	+27.5	+5.3
Dec. 19	+7.4	+4.6	+3.4	+1.2	+8.0	+18.0	+4.7	+7.6	+27.8	+2.1

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Load (Million Kw)	Oct.	76.9	77.2	71.1
Capacity (Million Kw)	Oct.	88.62	87.59	79.70
Production (Billion Kwhr)	Oct.	37.61	37.04	34.87
Hydro	Oct.	7.14	7.59	7.02
Fuel	Oct.	30.48	29.45	27.85
Fuel Consumption				
Coal (Million Tons)	Oct.	10.22	9.70	9.94
Oil (Million Barrels)	Oct.	6.78	6.16	7.16
Gas (Billion Cu Ft)	Oct.	96.85	105.30	82.62
Sales (Billion Kwhr)	Oct.	32.21	32.64	30.15
Residential	Oct.	8.70	8.55	7.72
Commercial	Oct.	5.62	5.90	5.09
Industrial	Oct.	15.56	15.67	15.16
Other	Oct.	2.33	2.51	2.17
Net Income Class A & B Companies ($ Million)	Oct.	76.19**	81.17	65.94
Estimated Dec. '54 Peak (Million Kw)	Oct.	94.8	95.0	95.7
Kwhr per Residential Customer (12 Month Average)	Sept.	2,303	2,289	2,131
Revenue per Kwhr Residential Service (12 Month Average)	Sept.	2.76¢	2.76¢	2.77¢
Canadian Production (Billion Kwhr)	Sept.	5.09	5.09	4.99

Business Statistics

FRB Industrial Production Index†	Nov.	130*	132	133
Gross National Product Annual Rate ($ Billion)	3rd Qtr.	369.0	372.4	345.3
EW 5 Industry Production Index	Oct.	127.6	128.3	127.4
ENR Construction Cost Index††	Nov.	128.1	128.0	123.4
BLS Consumer's Price Index	Nov.	115.0	115.4	114.3
NEMA Insulation Materials Sales Index†	Oct.	154	153	161
NEMA Electric Appliance Sales Index†	Oct.	91	101	113
NEMA Household Refrig. Sales Index†	Oct.	46	62	62
Metal Prices (Jan. 5)				
Copper, Conn. V., lb		$.29½-.30	.29½-.30	.24¼
Lead, N. Y. lb		.13½	.13½	.14¾
Zinc, prime Western E. St. Louis, lb		.10	.10	.13
Tin, Straits, qual. N. Y., lb		.85	.84¼	1.21½
Aluminum, ingot, base price		.21½	.21½	.20
Nickel, base price		.60	.60	.56½
Steel, billets, Pitts., ton		62.00	62.00	59.00
Steel, scrap, No. 1 heavy, Pitts., ton		31.00	35.00	46.00

* Preliminary ** Revised †1947-49=100 ††1949=100

Manufacturers Buying More Electrical Energy

Major industries have been purchasing more electrical energy in recent years, not only in actual amount, but as an increasing share of total fuels and energy purchased for power and heat. The 1952 Annual Survey of Manufactures (Dep't of Commerce) reveals that the total industrial kwhr purchases were 4% over the preceding year, while over the past five years they represent the substantial increase of 48%. In cost terms, though the totals for 1952 and 1951 are about the same, the total cost of fuels declined about 3% while purchased electrical energy increased about 6%.

Industry Group	Energy Purchased Million Kwhr 1952	1947
Food	11,330	8,427
Tobacco	221	155
Textile	11,780	8,288
Apparel	1,752	837
Lumber	3,616	1,503
Furniture	1,144	705
Paper	8,563	6,175
Printing and publishing	2,758	1,251
Chemicals	19,204	11,963
Petroleum and coal	5,622	3,753
Rubber	3,152	2,650
Leather	664	475
Stone, clay, and glass products	8,703	5,865
Primary metals	42,341	31,428
Fabricated metals	5,527	3,739
Machinery (except electrical)	7,735	5,401
Electrical machinery	5,018	3,156
Transportation equipment	9,599	5,552
Instruments	755	456
Miscellaneous	2,648	1,043
All industries, total	**152,132**	**102,822**

1952 Industry Group	Fuel Costs 000's of $	Energy Purchases 000's of $
Food	$208,284	$154,975
Tobacco	4,677	3,140
Textile	97,105	118,301
Apparel	24,857	37,222
Lumber	89,133	56,580
Furniture	15,451	20,316
Paper	185,607	71,861
Printing and publishing	26,666	46,267
Chemicals	279,139	150,088
Petroleum and coal	151,917	44,678
Rubber	25,662	31,523
Leather	14,643	12,574
Stone, clay, and glass products	267,237	92,560
Primary metals	1,513,879	299,700
Fabricated metals	88,872	83,143
Machinery (except electrical)	97,804	108,764
Electrical machinery	39,294	57,913
Transportation equipment	89,377	105,707
Instruments	10,145	11,677
Miscellaneous	30,935	41,919
All industries, total	3,260,684	1,548,908

FINANCIAL

West Coast PUC's Grant Hike

California-Oregon Power Co gets annual rate increase of $1,601,000 in Oregon and $440,000 a year in California

California Public Utilites Commission and Oregon Public Utilities Commissioner have granted to California-Oregon Power Co an electric rate increase totaling $2,041,000 a year as compared with $3,002,700 requested.

California's Increase 16% . . . In California the PUC gave an increase of 16%, or $440,000 on the company's application of $543,700 amounting to an increase of 20% on the original rate levels. Oregon PUC allowed an increase of $1,601,000 against $2,459,000 asked for.

As to the nature of the evidence, the California PUC stated that:

"Calculations developing the net for return on the **California portion** (emphasis supplied) were made for three 12-month periods ended March 31, June 30, and Sept. 30, 1953. Adjustments to the March 31, 1953, recorded figures were made in order to place this period on a normal year basis reflecting full year effect of previous rate increases, elimination of the now discontinued sales to Mountain States Power Co and Coos-Curry Electric Cooperative, nonrecurring sales to Inter-Company Power Pool, average water conditions and average temperatures, dump power and purchased power as affected by the preceding items, payroll increases and wages at March, 1953, levels, taxes at March, 1953, rates, depreciation accruals on a straight-line basis, and abnormal or nonrecurring items to normalize operating expense items."

On the basis of the company's California operation, the company stated that its present rate of return on a net original cost rate base, for 12 months ended March 31, 1953, amounted to 3.81% and that it was seeking a return of 5.30%. Significantly, for its whole property, the major portion of which is in the jurisdiction of the Oregon commissioner, the company stated that its return was 4.79%, or nearly 1% over its earnings in California, and was seeking proposed rates to yield 6.43% for its investment as a whole in both California and Oregon.

The PUC pointed out that for the 12 months ended March 31, 1953, June 30, 1953, and Sept. 30, 1953, the company, as a whole earned 5.14%, 5.03% and 4.81%, respectively. The commission continued:

"The above figures indicate a downward trend in the rate of return. No estimate was made by the company of its operations for the year 1954 but it is apparent from the record that the earnings would be less than the above figures indicate. Under any conditions disclosed by the record the present rates are producing less than a fair return on the rate base."

Investor Capital . . . Furthermore, the PUC in its findings stated that:

"It is apparent that applicant's earning position must be improved if it is to attract investor capital in amounts sufficient to finance the growth in plant which the discharge of its public duty reasonably demands."

As to its conclusions, the PUC stated that:

"We find that applicant has clearly demonstrated its need of and entitlement to increased revenues.

"In view of applicant's request that it be permitted to file rates for its California operations identical with those to be effective in Oregon, we shall authorize rates which will amount to an overall increase of approximately 16% and which will produce an annual gross revenue increase of $440,000 from California operations, based upon the average or normalized test period ended March 31, 1953. We find that this will produce net revenues not exceeding a fair return on the rate base."

Increases by Classes of Service . . . The PUC, in authorizing specific rate increases, stated:

"The rates hereinafter authorized are so designed that increases by classes of service will be as follows, with the total effect being that above-mentioned:

	%
Residential	15.1
Commercial	13.4
Industrial	17.3
Agricultural (excl. U.S.R.S.)	17.0
Street & Highway Lighting	20.0"

The effect of the above increases was to allow the company a 5% rate of return on its California operations.

Oregon's Increase 16% . . . The Oregon PUC granted the company an increase of 16%, or $1,601,000, as contrasted to California-Oregon's petition for a 20% increase amounting to $2,459,000 above the existing level of retail operating revenues.

The order of the commissioner stated that with respect to the company's future construction program:

". . . budget will be $15 million annually for the next five years to meet expected loads. The construction requirements will necessarily have to be financed largely through the issuance of long-term debt and capital stock. Likewise bank notes outstanding which become due April 1, 1954, in the total amount of $21 million will need to be so refinanced."

The order continued:

"The rate of return on an actually experienced, or 'recorded' basis during the 12 months ended March 31, 1952, in Oregon was 5.57% and for the 12 months ended March 31, 1953, it was 5.14%. In each case the rate base used was the average plant in service less the reserve for depreciation and reserve for amortization of limited term utility investments, less contributions in aid of construction and customers' advances for construction, plus working cash and materials and supplies. The working cash requirements were computed on the basis of two months' operation and maintenance expenses (exclusive of purchased power, fuel, and uncollectibles) plus one month's purchased power and fuel costs. This gross working cash requirement was then reduced by 50% because of the availability of certain tax accruals during part of the year."

Rate of Return . . . The order said:

"The results of operation on a recorded basis for the year ended

June 30, 1953, produced a rate of return of 5.03% in Oregon. The rate of return upon the same basis for the year ended Aug. 31, 1953, was 4.91% and the rate of return on the same basis for the year ended Sept. 30, 1953, was 4.81%."

In its conclusions, the commissioner's order went on to say:

". . . that the company should be granted an increase in rates sufficient to produce a 6% rate of return on the rate base . . ."

"The rate base, so determined, for the company's Oregon operations is $59,551,309.13 as of Sept. 30, 1953, and the adjusted utility operating income for the 12 months ended Sept. 30, 1953, is $2,804,372.73, which shows a rate of return of 4.70%.

"It is further concluded that the company should be granted an increase in retail operating revenues in Oregon of approximately $1,600,885.84 annually which is 16.16% of the adjusted Oregon retail revenues during the 12 months ended Sept. 30, 1953, and which, when added to a like percentage of the wholesale revenues which are to be similarly increased, will produce a 6% return on the rate base adopted above."

Seattle City Light to Use Earnings for Expansion

The Seattle, Wash., City Council has agreed to a plan to finance a $23 million City Light expansion program entirely out of surplus earnings without the issuance of bonds. The plan was proposed by Superintendent E. R. Hoffman.

The program calls for a $17 million diversion dam at Gorge Creek and installation of a fourth generator in the Ross powerhouse at a cost of $6 million.

Hoffman in December, which was his last month in office, expressed confidence that City Light will be able to pay for the work as it progresses, unless "there should come a too-severe leveling off in general business conditions." Should this happen, the construction fund could be replenished by the proceeds of a bond sale, agreed Corporation Counsel A. C. Van Soelen.

The fourth 90,000-kw Ross generator, like its three predecessors now

(*Continued on page* 158)

Today in Utility Finance

YIELDS (%)

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
1953									
Dec. 31	**3.07**	**3.12**	**3.34**	**4.17**	**4.32**	**4.62**	**5.07**	**5.57**	**5.51**
Dec. 24	3.08*	3.14*	3.37*	4.17	4.35	4.62	5.09	5.53	5.52
END OF QTR.									
4th 1953	3.07	3.12	3.34	4.17	4.32	4.62	5.07	5.57	5.51
3rd 1953	3.30	3.33	3.54	4.35	4.52	4.83	5.36	5.97	6.01
2nd 1953	3.34	3.46	3.64	4.47	4.70	4.88	5.52	5.93	6.10
1st 1953	3.15	3.23	3.39	4.16	4.41	4.66	4.95	5.24	5.50

Data: Reis & Chandler, Inc. * Dec. 23.

EARNINGS

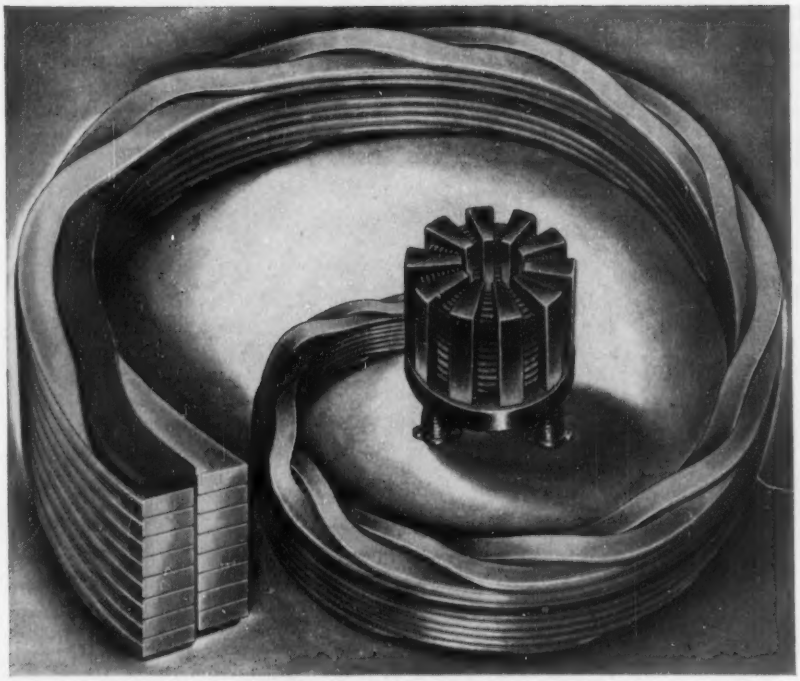
Company	Period Months Ended		Net Income 1953	Net Income 1952	Earnings Per Common Share 1953	Earnings Per Common Share 1952
Montana Power Co, subsidiaries	12	Nov.	$7,383,729	$7,936,618	$2.59	$2.81
Potomac Electric Power	12	Sept.	6,127,948	6,271,681	1.11(a)	1.14(a)
Public Service Electric & Gas	9	Sept.	18,694,310	16,656,370	1.48(b)	1.40(b)
Tampa Electric	12	Nov.	2,633,588	2,247,492	3.67	3.26

Notes—(a) Based on 5,117,040 shares; and (b) Based on the average number of shares on which dividends were paid.

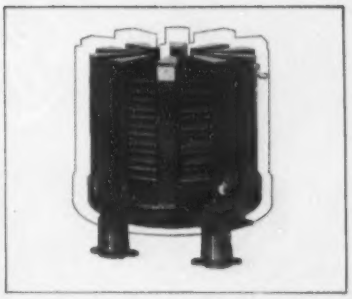
FINANCING

Company and Description	Amount of Offering (000)	Offering Price	Yield to Public
WEEK OF DECEMBER 31—JANUARY 6			
Bonds			
Consolidated Edison Co of New York—1st mtg 3¼% due 1984	$35,000	102.77	3.23%
Debentures			
Detroit Edison—debs 3¼% due 1969 (being offered common holders on the basis of $100 principal amount of debs for every 25 shares of common, record Jan. 6 to expire Feb. 1)	$43,358	$100.00	3.25%
SCHEDULE FOR JANUARY—FEBRUARY—MARCH—APRIL			
Bonds			**Bid Date**
Appalachian Electric Power—1st mtg due 1984	$20,000	.....	Jan. 11
Public Service Co of Indiana—1st mtg due 1984	25,000	.....	Jan. 12
Salt River Project, Ariz., Agricultural Improvement & Power District—electric revenues due 1960-82	5,000	.....	Jan. 12
Ohio Edison—1st mtg due 1984	30,000	.....	Jan. 19
Louisville Gas & Electric—1st mtg	12,000	.....	Feb. 16
Public Service Co of Oklahoma—1st mtg	12,500	.....	Feb. 16
Essex County Electric—1st mtg due 1984	4,000	.....	Feb. 17
Suburban Electric—1st mtg due 1984	4,000	.....	Mar. 3
Alabama Power—1st mtg due 1984	17,000	.....	Mar. 16
Georgia Power—1st mtg due 1984	11,600	.....	April 6
Debentures			
Otter Tail Power—debs 4¼% due 1964 (to be offered commonholders on the basis of $100 principal amount of debs for every 25 shares of common, record Jan. 22)	$2,500	$100.00	4.25%
Utah Power & Light—debs	15,000	.....	.....
Preferred Stock			
Central Illinois Electric & Gas—15,000 sh $100 par	$1,500	.....	Jan. 7(c)
Kansas City Power & Light—70,000 sh $100 par	7,000	.....	Jan. 14(b)
Iowa-Illinois Gas & Electric—40,000 sh $100 par	4,000	.....	Jan. 19
Mississippi Power & Light—60,000 sh $100 par	6,000	.....	Feb. 2
Common Stock			
Consumers Power—679,436 sh (being offered commonholders on a 1-for-10 basis, record Jan. 7 to expire Jan. 22; employees will be given right to unsubscribed shares up to 100 shares each)	$24,969	$36.75	5.99%
Ohio Edison—527,830 sh (to be offered commonholders on 1-for-10 basis, record Jan. 14 to expire Jan. 29 with an oversubscription privilege)	.....	.....	.....
Utah Power & Light—about 200,000 sh	.....	.....	.....
Kansas City Power & Light—225,460 sh	.....	.....	Jan. 14(b)
Black Hills Power & Light	300(e)	.....	.....
POSTPONED, UNSCHEDULED, AND/OR UNDER CONSIDERATION			
Bonds			
Southwestern Public Service—1st mtg	$12,000(e)	.....	.....
Houston Lighting & Power—1st mtg	25,000	.....	.....
Public Service Co of Colorado—1st mtg	15,000	.....	.....
Jersey Central Power & Light—1st mtg	6,000(e)	.....	.....
Metropolitan Edison—1st mtg	3,500(e)	.....	.....
New Jersey Power & Light—1st mtg	3,000(e)	.....	.....
Pennsylvania Electric—1st mtg	12,500(e)	.....	.....
Pacific Gas & Electric—1st mtg	.....(a)	.....	.....
Common Stock			
Southwestern Public Service—about 272,500 sh. (to be offered on 1-for-14 basis)	.....	.....	.....
General Public Utilities—about 600,000 sh (to be offered on a 1-for-15 basis)	.....	.....	.....

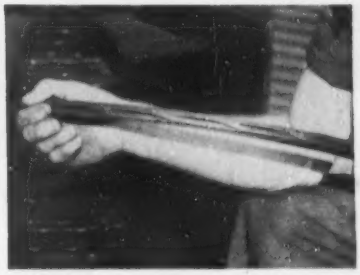
Notes—(a) Amount undetermined; (b) Blyth & Co—First Boston Corp group, underwriters; (c) Stone & Webster Securities Corp underwriter; and (e) Estimated.



CONTINUALLY TRANSPOSED RECTANGULAR CONDUCTORS—shown here schematically—are made possible by a specially designed machine. This exclusive G-E reactor feature results in more uniform current distribution and lower power losses.



COMPACTNESS Transposed conductors decrease volume up to 20%. You can fit G-E reactors in vaults too small for others.



ECONOMY By choosing G-E reactors with aluminum conductors you can save 10% on price without any sacrifice in reactor quality.

Compare . . . and you'll choose G-E Reactors

"Extra service" features of G-E cast-in-concrete reactors mean maximum protection and longer service life.

Industry's favorite for more than 35 years, G-E cast-in-concrete reactors offer you "extra service" features that make possible almost unlimited life with virtually no maintenance. For example:

Continually transposed conductor, an exclusive G-E feature, assures more uniform current distribution . . . lower losses . . . smaller dimensions.

Non-aging glass insulation gives greater short-circuit protection than any other wound insulation used in reactor manufacture . . . does not deteriorate even under high overloads . . . remains unaffected by moisture.

Wet steam curing of concrete assures full strength at shipment . . . eliminates potentially dangerous "in service" curing.

You also get such features as: good clearances; crossovers made within concrete; smooth, flameproof black phenolic varnish finish; and metal housings, complete with entrance and exit provisions, to minimize stray currents and protect reactors from damage.

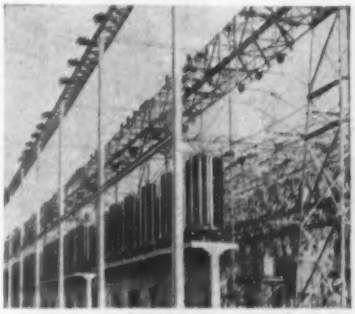
And you can have a 10% price reduction!

You can buy sturdy, dependable G-E cast-in-concrete reactors with either copper or aluminum conductors. By choosing aluminum conductors you can get the same long life, high short-circuit strength and low maintenance obtainable with copper conductors . . . at a 10% price reduction.

For full information contact your nearest G-E Apparatus Sales Office or write to General Electric Company, Section 422-8, Schenectady 5, New York.

GENERAL ELECTRIC

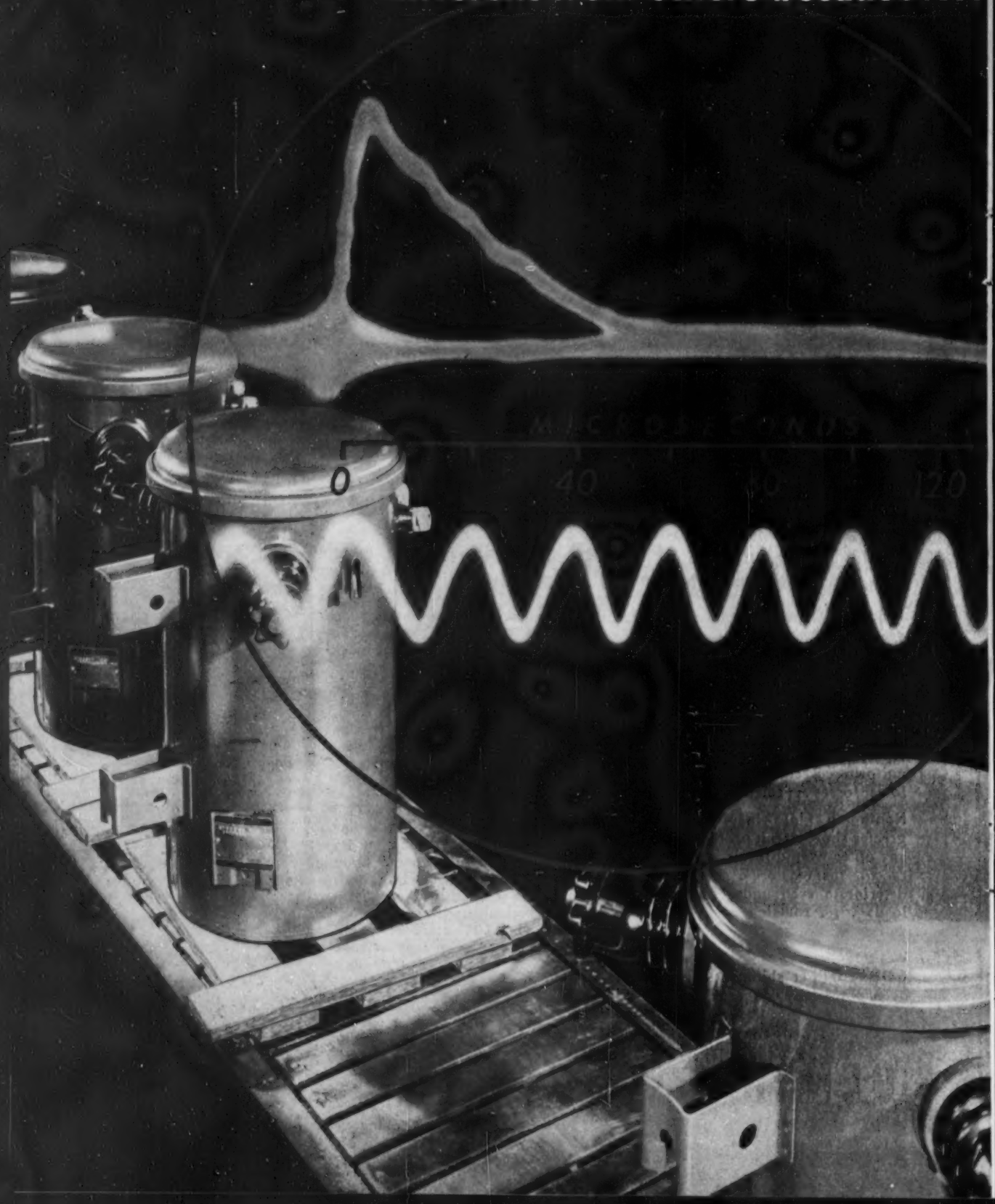
AVAILABILITY You can get shorter shipments when you order RM reactors thanks to G.E.'s "repetitive manufacture" program.



DURABILITY of G-E reactors is dramatized by this 30-year-old installation. It has given no trouble, needed little maintenance.

DISTRIBUTION TRANSFORMERS

different from others because....



...Production-line impulse testing,

the invisible inspector, detects faults before they can occur

Automatic fault detection, standard General Electric procedure in the manufacture of Spirakore* distribution transformers (50-kva and below), is a quality-control measure that assures you "extra years of service."

BOTH HIGH- AND LOW-VOLTAGE WINDINGS are tested on the production line *without lightning protection* of any kind on the transformer. Any hidden weakness is detected automatically and the unit rejected.

The oscillogram superimposed at the left shows the voltage wave shape across a neutral impedance in series with transformer high-voltage winding —no failure indicated. When failures do occur, an electronic circuit actuates an audible signal and the faulty unit is removed from the production line.

REMEMBER... all transformers are not alike . . . compare the G-E plus features in the chart below and see for yourself.

For more information on distribution transformers, either unit-type or conventional, contact your nearest G-E sales office, agent or distributor, or write to General Electric Company, Section 431-3, Schenectady 5, New York.

**Registered trade-mark of General Electric Co.*

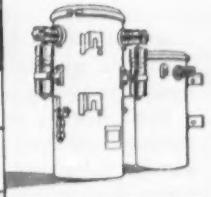
You can put your confidence in—

GENERAL ELECTRIC

ALL TRANSFORMERS ARE NOT ALIKE

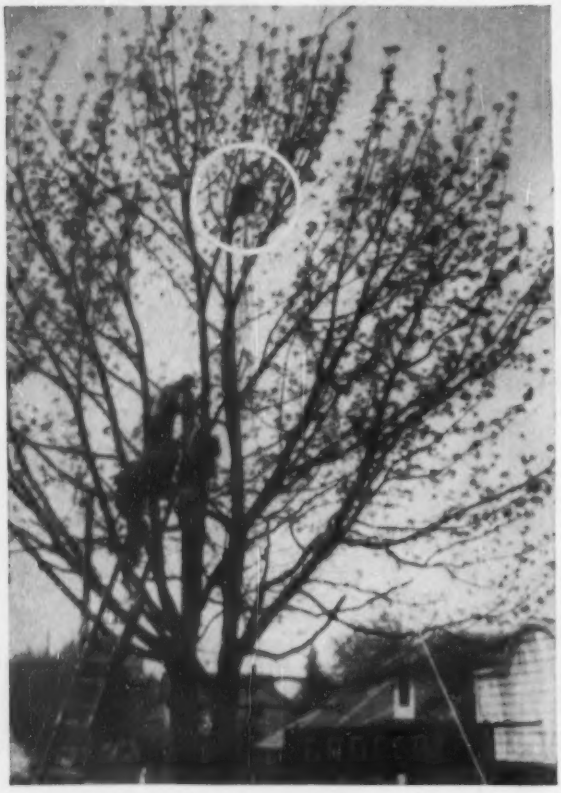
(make this simple comparison and see)

FEATURE	General Electric	Mfg. A	Mfg. B	Mfg. C	Mfg. D	Mfg. E
Production-line impulse testing	YES	NO	NO	NO	NO	NO
Nitrile rubber gaskets at all tank openings	YES	NO	NO	NO	NO	NO
Strenicor pressure terminal clamps	YES	NO	NO	NO	NO	NO
Insulated clamp-type connectors on tank wall hv bushings	YES	YES	YES	NO	YES	YES
One-piece cover band	YES	NO	NO	NO	NO	YES
Gapped valve-type arresters	YES	NO	NO	NO	NO	NO
Nationwide company-operated service facilities	YES	YES	NO	NO	NO	NO



UNIT-TYPE CONVENTIONAL

"Take your choice G. E. makes both"



SPINNING AERIAL CABLE to messenger through 10,650 ft of tree-lined streets was completed without serious difficulty. Blocks along main highway averaged 400 ft between intersections

CABLE SUPPORTS across intersections consisted of iron rings tied at 8-ft intervals with cotton rope. Spinner pushed rings and rope across span as it lashed cable to messenger

Spinning Street Light Cable Saves $1,725

MERLE P. BAILEY, Electrical Engineer, Eugene Water & Electric Board, Eugene, Ore.

Spinning street light cable on aerial messenger saved Eugene Water & Electric Board $1,725 over cost of underground installation. Assembly in the field also allowed the utility to take advantage of better delivery as compared with delivery of pre-assembled self-supporting cable. Installation of 41,300 ft of series circuit, including 10,650 ft of street light cable through right of way consisting of closely-planted old trees lining the through curb, was completed without serious difficulties by a crew inexperienced in lashing high-voltage cable to a messenger.

Street lighting project is part of the modern highway lighting installation on U. S. 99 through Eugene. Type II and III luminaires mounting horizontal burning 21,000-lumen mercury vapor lamps were installed 30 ft above pavement. Mast arms of 8 to 12-ft upsweep type are mounted on selected cedar poles treated with preservative.

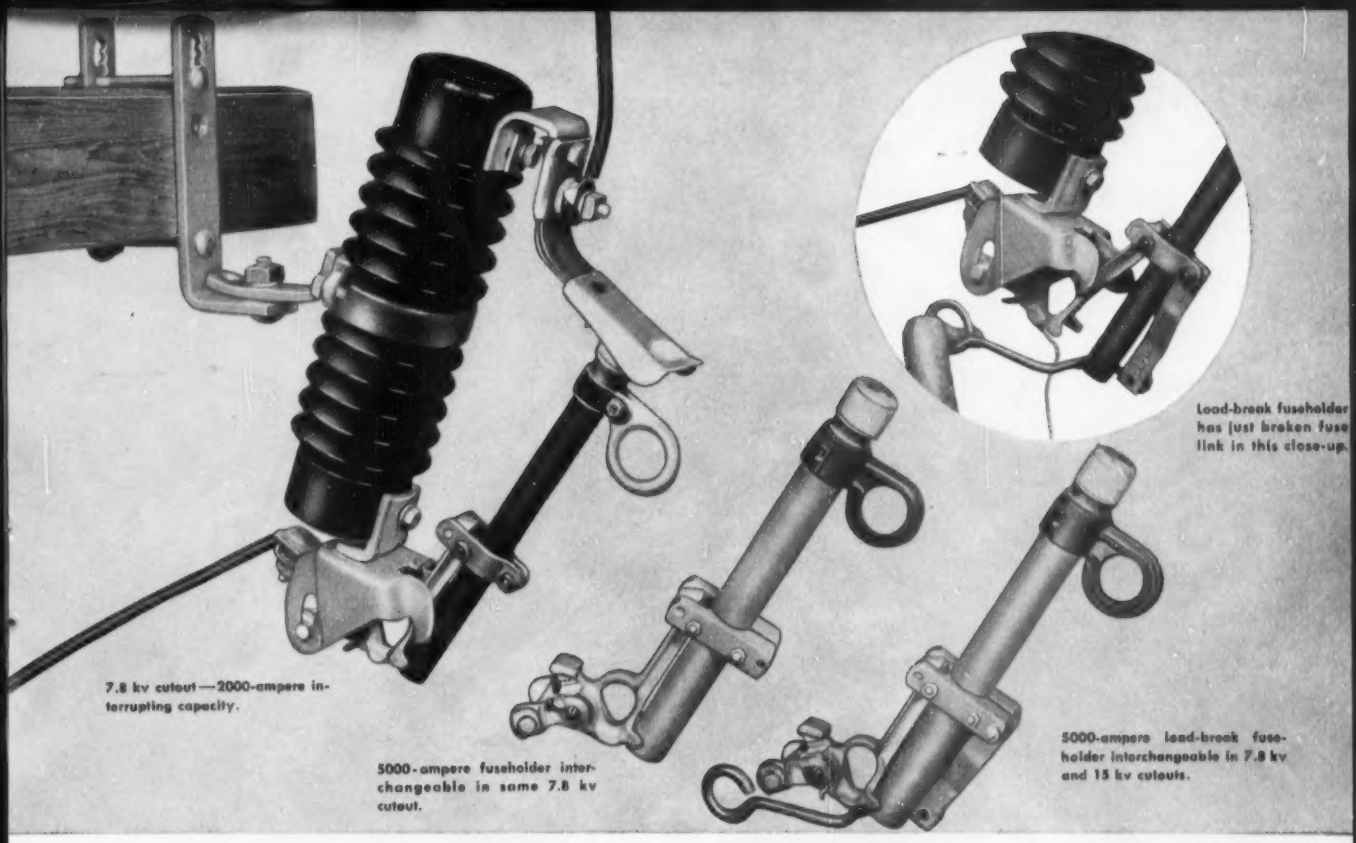
First phase of operation was tree trimming by city crews that removed large limbs that met in center of the street about 17 ft above the pavement. After main trimming, poles were set and installation of equipment began. Mast arm, luminaire, ballast, and through-bolt with 3-hole messenger clamp were installed on poles.

Cable for the job was rated 5 kv with 4/64-in. neoprene jacket and was delivered in 3,000-ft lengths. Cable manufacturers approved its use for lashing with 0.091-in. aluminum alloy wire. After down guys and anchors were placed at each end of cable sections, a ⅜-in. high-strength messenger was pulled with No. 9 iron wire. Pulling wire was carried on each pole by a three-hole clamp acting as guide in vertical position. Pulling was done by winch truck through a come-along. Iron wire was re-reeled as pulled for later use.

Messenger was cut at the anchor pole near reel truck and secured for loading. In a few instances, branches were removed to let cable take proper stringing position. After pre-stressing, messenger was secured at anchor near winch truck.

About 2,000 ft of messenger was pulled without iron wire through trees that were 50 to 100 ft apart. Hand line 200-ft long was thrown through the tree and pulled by two men until friction required use of a truck. Mes-

(*Continued on page* 114)



7.8 kv cutout—2000-ampere interrupting capacity.

5000-ampere fuseholder interchangeable in same 7.8 kv cutout.

Load-break fuseholder has just broken fuse link in this close-up.

5000-ampere load-break fuseholder interchangeable in 7.8 kv and 15 kv cutouts.

NEW G-E OPEN DROPOUT CUTOUT

For FAULT PROTECTION—standard or heavy duty and LOAD BREAK—up to full load at any power-factor.

New simplified design of General Electric 7.8 kv and 15 kv, 100-ampere cutouts have these extra features:

Birdproof Construction accomplished by unique method of clamping the mounting support to the opposite side of insulator from live parts.

Liberal electrical and mechanical strength. New hollow tube wet process porcelain has under-cut petticoats for generous creep and strike distance; and porcelain insert fired within tube provides inside solid barrier between top and bottom live parts. Screen prevents insect nest within porcelain. Clamping U-bolt around porcelain is insulated with molded polyvinyl chloride having excellent insulating and weathering characteristics.

Compression bolting to porcelain—top and bottom fittings are bolted to insulator with porcelain under compression—for maximum mechanical strength. Compression clamps inside the porcelain maintain tight assembly.

Shielded top contact and latch—by roof-shaped contour and having ball-point contact surface to top of fuseholder, the top contact and its latch are protected from dirt deposits and sleet.

Other distinctive features are retained: Hinge guides allow slamming fuseholder from any angle; threaded cap seal at upper end of fuseholder forces expulsion gases downward; silver-plated contacts shielded from corrosive agents; vertical or angle-tilted swivel mounting with EEI-NEMA bracket; latch provides time-delay opening—assures fault current interruption before dropout action occurs; fuseholder tube of fiber and fabric-base Textolite* is water resistant, will not warp or split; close coupling of fuseholder to porcelain prevents multiplication of recoil forces.

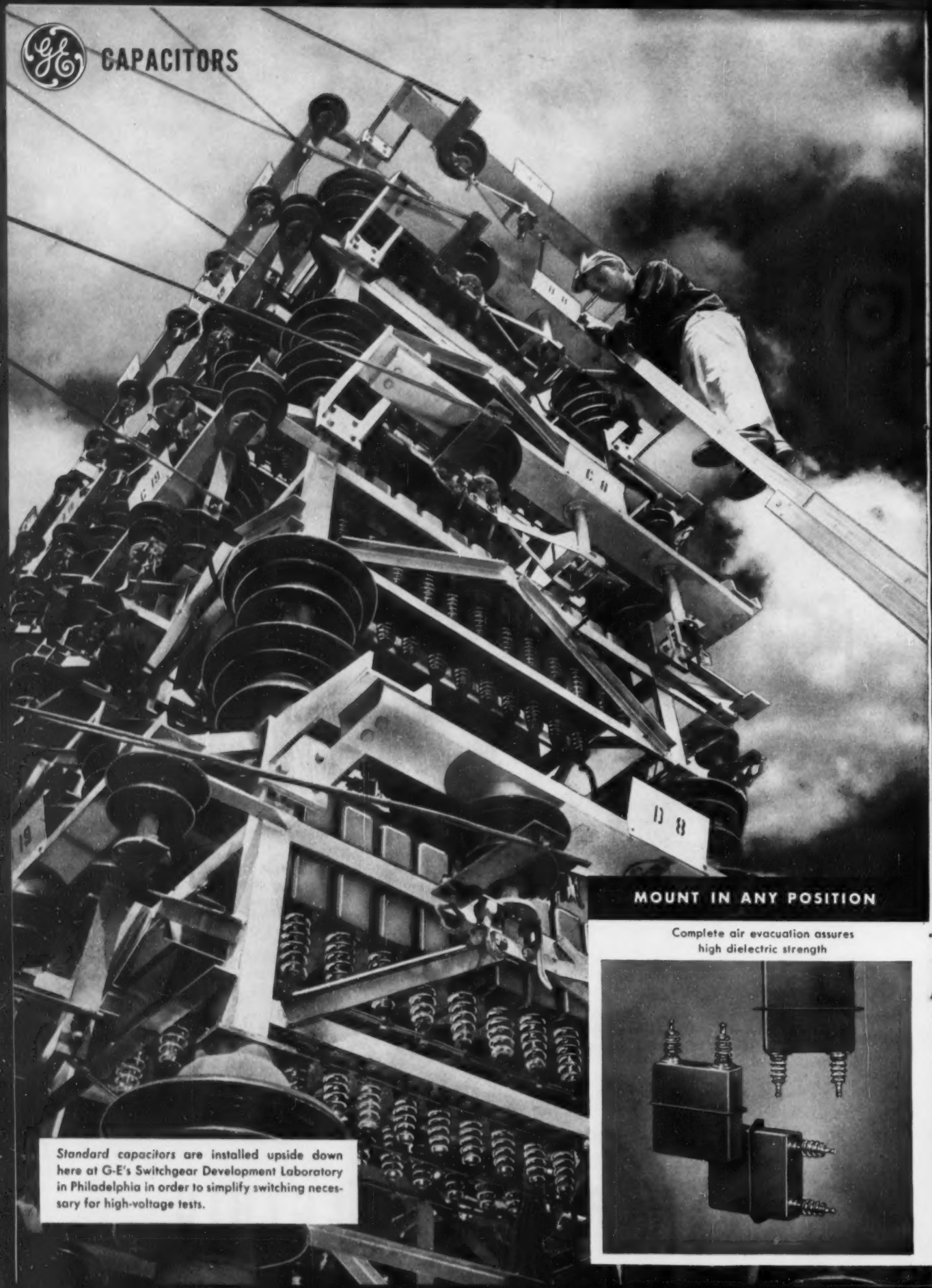
For more information on these new open cutouts, contact your nearest G-E Sales Representative, or write to General Electric Company, Section 433-4, Schenectady 5, New York.

*Reg. trade-mark of General Electric Company

You can put your confidence in—

GENERAL ELECTRIC

CAPACITORS



Standard capacitors are installed upside down here at G-E's Switchgear Development Laboratory in Philadelphia in order to simplify switching necessary for high-voltage tests.

MOUNT IN ANY POSITION

Complete air evacuation assures high dielectric strength

GENERAL ELECTRIC CAPACITORS CAN BE MOUNTED IN ANY POSITION

All air is removed from case and bushing for high insulation strength no matter how installed

General Electric Pyranol* capacitors with glass bushings operate in any position . . . even upside down as shown in this capacitor bank. And the uniformly high-strength insulation which makes these applications possible means longer life for all G-E capacitors—no matter how installed.

NO AIR VOIDS in a G-E capacitor—all air and moisture are removed by heat and vacuum before Pyranol impregnation, and the unit is then sealed under Pyranol to prevent re-entry of air. This technique eliminates air voids which might otherwise cause service failure. Combined with sheets of thin, strong Kraft paper, this carefully controlled impregnation assures uniformly high-strength insulation.

Pyranol, the liquid impregnant, completely fills the spaces in the case and in the hollow bushings. Pyranol's high dielectric strength makes possible an unusually small unit with stable operating characteristics and low cost. Remember, whether you need to increase kw capacity of feeders, transformers, regulators, or the entire system back to the generators . . . whether you want to improve feeder voltage levels . . . reduce overall losses . . . or defer the expense of major changes in feeder layout, General Electric Pyranol capacitors are the practical, low-cost solution.

Capacitors are the only items of major electrical equipment that cost less today than in 1940. No other electrical investment does so much for so little.

Why not investigate the values of G-E Pyranol capacitors today? Contact your G-E Apparatus Sales Representative or write General Electric Company, Section 441-8, Schenectady 5, New York.

*Registered trade-mark of General Electric Company

Progress is our most important product

GENERAL ELECTRIC

SMALLEST AND LIGHTEST

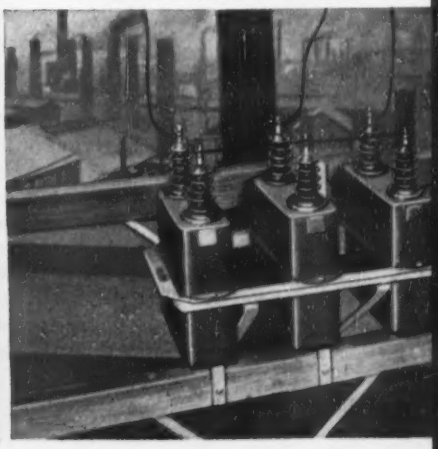
Easier to handle and install
—unexcelled reliability

WELDED GLASS BUSHINGS

Provide high mechanical strength—
permanent hermetic seal

TRIPLE-PROTECTED CASE

Protects even in corrosive atmosphere
—cuts repainting expense



Spinning Street Light Cable

(*Continued from page* 110)

senger was placed on a clamp bolt from a ladder truck as each pole was passed. Two ladder trucks used to sight from pole to pole as messenger was pulled through alternated positions at poles to keep up with pulling. Ladder trucks eliminated marring of poles.

Series circuit cable was pulled through with a hand line. When friction became too much for two men on ground, cable was clamped at a pole and spinner made ready to lash between poles. After spinning was under way, the cable end was connected to the lamp ballast and ladder truck moved ahead. Cable-reel truck also was moved and placed for next pull.

As spinner reached each pole, lashing wire was secured to messenger and spinner was moved around pole to the next span. Cable was formed in a loop and secured to the messenger, a new 325-ft reel of lashing wire threaded and clamped to messenger, and next section of cable was lashed. After loop in cable was cut and made up on ballast, ladder truck moved ahead.

Occasionally the truck stopped along a span to help get spinner past small branches or to hold messenger away from close limbs that fouled the lashing. For crossing intersections, cable was supported by iron wire rings tied at 8-ft intervals with cotton rope. Rings were pushed by spinner along messenger to next pole. Supporting rings were not used in heavy tree sections because rope loops would catch on branches. However, closely planted tree sections usually held cable within 3 ft of messenger so that spinner would pick it up on leading pulley.

By holding tension on cable ahead of the spinner, lashing wire was wound tightly behind spinner. First spinning was done at 18 lb tension but later was raised to 35 lb to make a better bind in sections where branches stopped machine in midspan several times. Lashing wire was secured to messenger with a C-cable lashing clamp and cable was banded at each ballast take-off.

At four intersections, street light cable was attached to five 30-ft steel traffic signal posts. On these posts, messenger was attached and spinning was done in same manner as on cedar poles. Three 6-ft fitted extensions for mast arms, ballasts, and aerial cable were attached in the field on existing signal posts by a shop welder working with street light crews. Where small trees could be trimmed and for closing series loop from one side of street to the other, No. 6 hard-drawn copper was used.

Time-Run Tests Detect Meter Errors at Low Cost

E. H. TYSON, Superintendent of Meters, Pennsylvania Power & Light Co, Hazleton, Pa.

A "time run" test board detects occasional meter errors not readily detectable through the regular calibration test. It is a test which is used by other meter departments but an improvement has been made in test and handling time. This test prevents Pennsylvania Power & Light Co's meters from being put in service with wrong register ratio or wrong coils. From 300 to 500 meters per day can be tested with this board and it has the feature of making the check at less cost than by doing without it.

The test dispenses with a mechanical check of register ratios at about one fourth the cost. The latter check is not as complete a safeguard against errors that are caused by incorrect register ratios or by voltage or current coils that do not correspond to the nameplate rating.

TIME-RUN TEST BOARD simulates load service conditions for single-phase and two-element network watthour meters up to 25-amp capacity, after meters have been calibrated

The time-run test is set up so that no internal connection is touched. Only external connections are made by placing meters on standardized connection blocks or adaptors to eliminate the variable human element. The board accommodates any single-phase and two-element network meters up to 50-amp capacity. It has seven banks of fifteen positions each, four for socket-type and three for A-base meters.

Each bank is controlled by master meters equipped with contact devices. The latter controls relays that energize the loading circuit. The control circuit is automatically reset at the end of each run to eliminate lost time.

Two loading circuits are used for each bank to avoid opening potential test links on 3-wire meters. The loading values are 10 amp for 5- and 10-amp meters, and 30 amp for all other meters that are put through the test.

Master meters register one kwhr each run or cycle of operation. Ten-amp meters are put through two cycles of operation, which is necessary to

(*Continued on page* 118)

Coming February 13TH

5-page Home Lighting ad in SATEVEPOST

Features Light Conditioning by leading decorators

THIS February, over 4,500,000 families will be exposed to the most powerful and compelling advertisement in the history of home lighting!

It's a 5-page section—4 pages in full-color—in the February 13th POST. It features light conditioned rooms by four of America's leading interior decorators: living room by C. Eugene Stephenson, bedroom by William Pahlmann, bath by Bertha Schaefer, kitchen by Melanie Kahane.

The beautiful, interesting rooms created by these outstanding decorators prove dramatically that light conditioning is an *essential* ingredient of home fashions. They demonstrate impressively that light conditioning fixtures and portable lamps bring new beauty and comfort to any home.

Merchandising tie-ins? Unlimited! General Electric's 5-page advertisement on fixtures and portable lamps that are "lovely to look at and glorious to see by" offers a real opportunity for home lighting promotion. It's the perfect time to sponsor a Lamp Fashion Festival and show Light Conditioned homes.

START PLANNING YOUR 1954 HOME LIGHT CONDITIONING PROGRAM NOW! Complete information is available on how to launch a Lamp Fashion Festival in cooperation with your local department and furniture stores. Contact your General Electric Lamp District sales office or write General Electric, Dept. 166-EW-1, Nela Park, Cleveland 12, Ohio. We'll be glad to give you all the help and information you need to get your Lamp Fashion Festival Program rolling.

You can put your confidence in—

GENERAL ELECTRIC

READY TO START moving the 750-kva General Electric network transformer, with submersible protector, from trailer to vault. Notice the room air-conditioning units in the windows—one of the reasons why more capacity is needed here.

Potomac Electric, Washington, D.C., installs G-E network unit to meet extra-heavy load demands

System reinforced with 750-kva G-E transformer and network protector

The flexibility and ease of expansion provided by a secondary network system certainly "pays off" for Potomac Electric Power Company in downtown Washington, D. C. Flexibility of the system permits load growth additions with minimum interference to service in the highly concentrated downtown area.

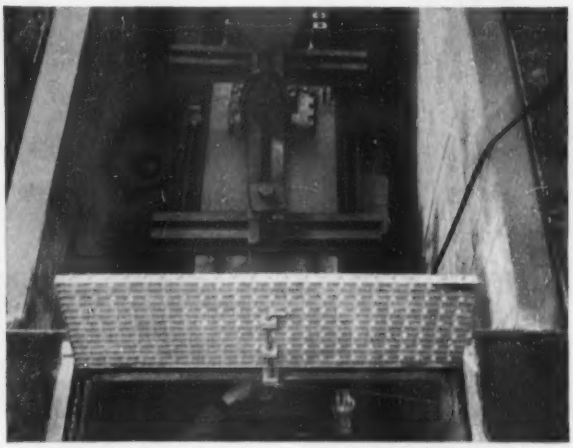
The financial district is experiencing a phenomenal growth and the consequent heavier load requirements, including air-conditioning in existing buildings in the area, necessitated installation of this 750-kva G-E network transformer. The unit, equipped with a submersible automatic network protector, is located at 730—15th Street, N. W., directly in front of the American Security and Trust Company building.

Compactness of G-E network units permits minimum vault depth (7 feet to roof slab) for lower installation cost.

It pays to start a network. Although the change from a radial to a network system means substantial initial expense, future increases in capacity require less investment with a network system. With a growing load, the sooner the network system is started, the lower the ultimate cost. Why not investigate the advantages for your system?

For help in solving your network problems, and for complete information on the many advantages of G-E standardized network units, get in touch with your nearest G-E Apparatus Sales Office, or write for Bulletin GEA-5024, General Electric Company, Section 431-201, Schenectady 5, N. Y.

ALMOST IN PLACE and with minimum inconvenience, even in a congested downtown area. Note the G-E submersible automatic network protector on the low-voltage end of the transformer.



CENTERING UNIT in vault prior to cabling. Convenient location of cable terminals on G-E units makes minimum size vaults practical—simplifies connections for fast installation.

You can put your confidence in—

GENERAL ELECTRIC

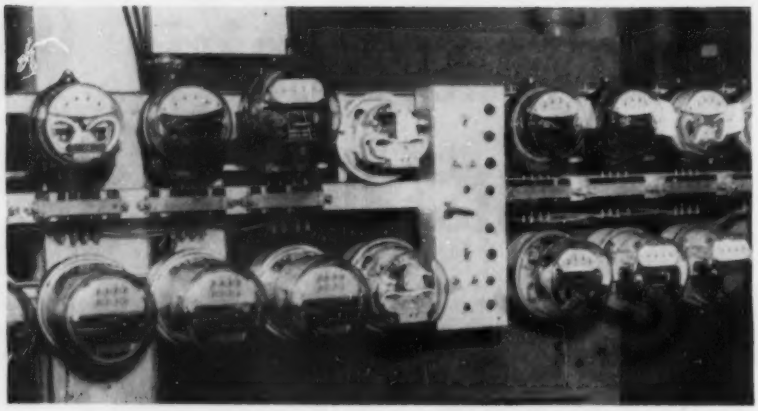
Time Run Tests Meters

(*Continued from page* 114)

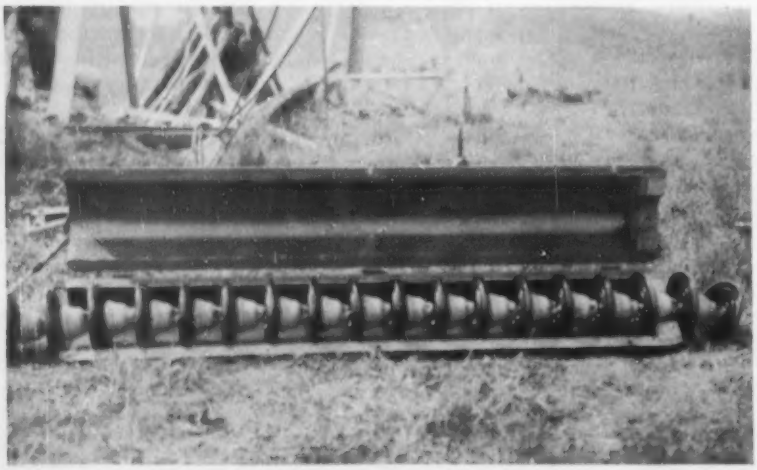
detect small difference between register ratios, such as 277/9 and 33⅓. The 5- and 10-amp meters require 50 min per run and 15-amp meters require 12 min.

One inspector handles the time runs. He also performs a mechanical inspection (cleanliness, alignment and tightness of parts) on 350 meters of the daily production schedule. Part time of a second inspector is required when production is in excess of 350 meters.

When sufficient meters are placed on one board section, the operator puts the loading and voltage switches in position and pushes the start button. Then he turns to other duties until the run is completed. After the run, each meter reading exactly on zero is lifted off and pushed across the metal-top table to the sealing operation. Meters not reading on zero are laid aside for careful re-examination.



CONTROL EQUIPMENT for one bank of meters on "time run" includes pushbutton and relay box with a master meter in top and bottom rows and at left of box



INSULATOR CRADLE protects an 18-unit insulator string in hoisting and installation

Cradle Protects Insulator Strings

W. P. CARTER, Supt System Transmission, Appalachian Electric Power Co, Bluefield, W. Va.

An insulator cradle was developed to aid hoisting and installing insulator strings during construction of the 330-kv Sporn-Kanawha transmission line. The 18- and 19-unit insulator strings were used for suspension and dead-end assemblies. They had the sagging block attached to the lower unit and were handled in the cradle to avoid damage and possible breakage.

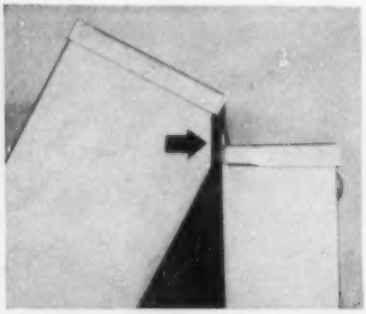
The cradle for an 18-unit insulator string is illustrated. It consists of two reinforced, semi-cylindrical metal halves hinged together and arranged for locking in closed position. Two top and bottom insulator units extend beyond the cradle so the terminal units are free to swivel to aid attachment to tower.

The cradle is 16-gage steel sheeting reinforced with $\frac{3}{16}$ x 1¾ x 1¾ in. angle irons and ¼ x 1-in. steel straps. This construction withstands rough treatment. The shackle which is attached one third the length of the cradle from its upper end is for the hoist hook. The lowest shackle permits attachment of a guide line.

Modified Enclosure Aids Opening

D. W. NEWELL, Meterman B, Mobile Meter Testing Laboratory, Ohio Power Co, Canton, Ohio

Covers of outdoor meter enclosures need be swung forward only 30 deg to remove them if the rear upper corners



METER ENCLOSURE COVER has rear upper corners cut at a 60-deg angle

are cut off at a 60-deg angle. This simple enclosure modification does not sacrifice its tamper-proof features, nor its weatherseal.

As originally designed covers had to be swung 90 deg or to the horizontal position to disengage them from the backpan. That was a disadvantage in installations where customers constructed additions to buildings or planted shrubbery which prevented swinging the cover far enough to remove it.

DELTA-STAR'S *New* "QB"

INTERRUPTING DEVICE FOR ALL AIR SWITCHES

VERTICAL, HORIZONTAL, HOOK STICK

for opening line charging currents, transformer magnetizing currents and small load currents at voltages from 15 KV to 161 KV.

Easily Installed on Switches Now in Service

Necessary phase spacings and clearances are not increased by the addition of the "QB" Device. The current path through a closed switch is through its main blade and contacts. The quick break blade is not in the current path until the switch starts to open; then the current is transferred from the main switch contact to the quick break blade.

Simple, Positive—No Additional Effort Required in Opening Switches When Frozen

The quick break blade is carried without extra effort. Ice on the main switch blade and contact is broken before effort is expended in breaking the ice on the "QB" attachment.

Spring and Current Carrying Members are Independent

Spring actuated quick break blade is mounted on the switch contact stack. This design permits the use of a more substantial construction, a heavy independent spring driving mechanism and much greater opening speeds.

"QB" Quick Break Device applied to a MK-40 Vertical Break Switch.

Fig. 1—Vertical Switch blade (A) is closed into the main contact (B) and the quick break blade (C) is in neutral position.

Fig. 2—As main switch blade rises, it picks up quick break blade which is lifted through a 90° arc against a strong torsion spring (D).

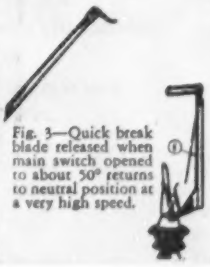


Fig. 3—Quick break blade released when main switch opened to about 50° returns to neutral position at a very high speed.

WHEN YOU WANT THE BEST IN HIGH VOLTAGE EQUIPMENT SPECIFY DELTA-STAR

DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.
OF PITTSBURGH
2437 FULTON STREET, CHICAGO 12, ILLINOIS
DISTRICT OFFICES IN PRINCIPAL CITIES

SELF-CLEANING IS

Perhaps you are now faced with a contamination problem in a particular area and would like more information regarding the Pinco No. 1925 Universal Insulator. If so, drop us a line or contact the Joslyn Mfg. & Supply Co. office in your locality. Either way, you'll get a prompt and satisfactory answer.

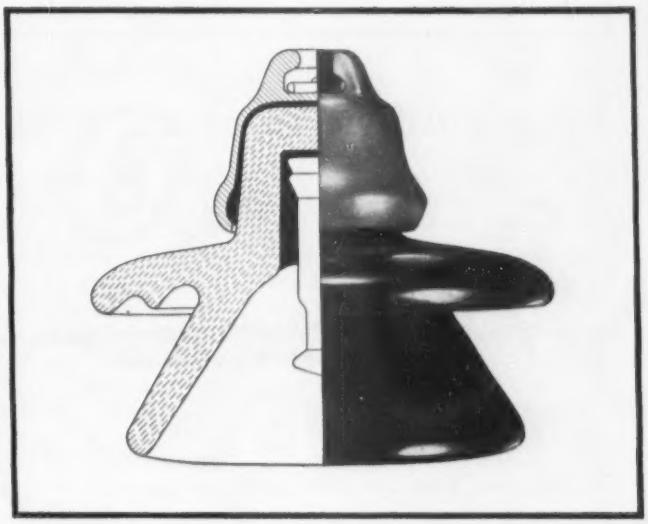
IMPORTANT

in insulators too!

this is especially true in areas where excessive insulator contamination is an operational hazard.

Prior to the introduction of the Pinco No. 1925 "Universal" Insulator twenty odd years ago, many utilities were continually faced with "outages" and the long, tedious and costly job of cleaning insulators in order to maintain efficient line performance in areas affected by airborne contamination such as fly ash, salt spray, etc. The installation of Pinco "Universal" Insulators on these same lines soon proved however, that here at last was an insulator so designed that it literally "washed" itself . . . eliminated costly outages and materially reduced the necessity of frequent manual cleaning.

Now let's see why Pinco "Universals" do their job so well. First of all, the leakage distance is a big 17" instead of 11" as on standard designs. The petticoats are on the outside, shielded above by the bell, below by the hood. This same hood which is long, tapered and self-cleaning, acts as a spatter-baffle to clean the petticoats. In strings, the interior of the hood is shielded by the unit below thus lessening contamination and the need for manual cleaning. That, in a nutshell is why Pinco "Universal" Insulators perform better . . . stay cleaner longer!

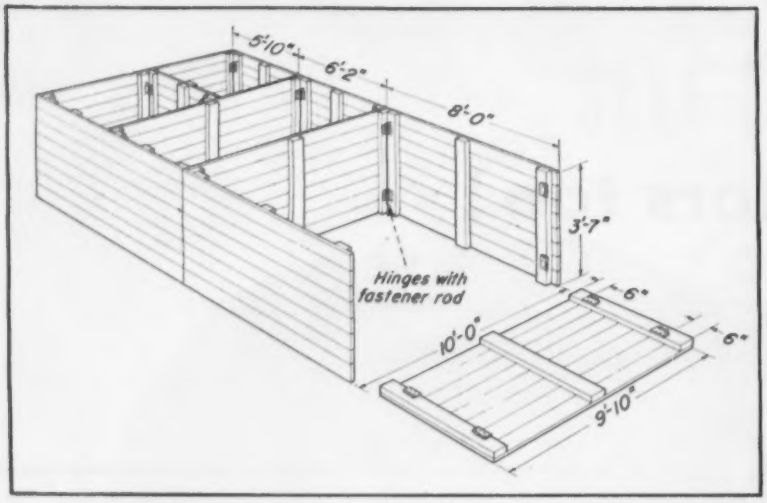


Here is how Pinco 1925 Insulators rated in a competitive "fog operation" test conducted by a western utility . . .

FIRST on "fog arc over"
FIRST on sustained voltage "in fog" . . . No arc over
FIRST on sustained voltage "in direct spray" . . . No arc over
FIRST on both self-cleaning and manual cleaning characteristics.
SECOND on "sluice arc over"
EXCELLENT on radio interference characteristics

The Porcelain Insulator Corporation
LIMA, NEW YORK

Suspension Insulators . . . Clamps and Fittings . . . Switch and Bus Insulators . . . Distribution and High Voltage Pin Types . . . Guy and Tree Insulators . . . Special Porcelain.



Scrap Bins Save Space and Time

E. J. CLOUSER, Stores Supervisor, Kentucky & West Virginia Power Co, Williamson, W. Va.

Portable storage bins are used by Kentucky & West Virginia Power Co that are compactly storable, easily adaptable to available space, permit classified storage of scrap, and expedite removal of contents on scrap-sale days. Bins are simple and relatively inexpensive to construct if scrap lumber from crating is used.

Knock-down scrap bins were constructed in separable sections, as illustrated. All or any parts can be used or stored flat, according to requirements. Sections can be easily assembled into combined or separate storage bins to fit either large or small spaces. No bin flooring is used.

Sectional sides were made with 1-in. planks nailed to 2 by 4's for corner and center supports, and are joined by two conventional 3.5 by 3.5 in. butt hinges in each corner. Removable pins, such as long welding rod, pass through both the top and bottom hinges. Panels in 6, 8 and 10-ft lengths are convenient for assembly in various combinations.

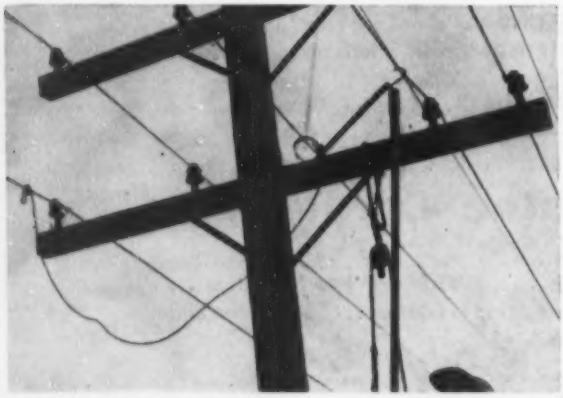
The front section of any bin can be completely removed to facilitate access by the scrap dealer, saving time of persons conducting the scrap sale.

Rods Replace Clamps

Strong neat deadends are made by Detroit Edison Co with preformed armor rods. The result is savings in labor and material. These rods take the place of clamps, and slip easily into place over the conductor. They develop full strength of the conductor, and can be used on all sizes and types of conductor.

Sound and Motion Show that Line is Hot

GLENWOOD DAVIS, Meter Foreman
D. O. ROBERTSON, Line Crew Foreman
Idaho Power Co, Pocatello, Idaho



LINE TESTER consisting of fuse holder, extra flexible wire, and hot tap clamp is made for two voltages, 15 kv and 25 kv. Steel spring flips wire from holder if fuse is blown

Sound as well as motion to indicate that a distribution line is still energized are main safety features of a testing device used by line crews of Idaho Power Co. Line testers in two ratings, 15 kv and 25 kv, are made in the company's machine shop. Device was built by authors for testing lines before grounding them.

Line tester consists of an expulsion type of tubular fuse holder with a copper hook welded to one end. Hook assures a positive connection to conductor. Attached to arm of holder is strip of spring steel, the free end of which is bolted to fuse wire when tube is loaded. Connected to holder is 8 ft of extra flexible 600-v wire with a hot tap clamp on opposite end.

In testing a line, the fuse holder is loaded with 1-amp fuse wire. Tap clamp is connected to ground wire before fuse holder is hooked over the phase wire. Holder is placed with a hot stick.

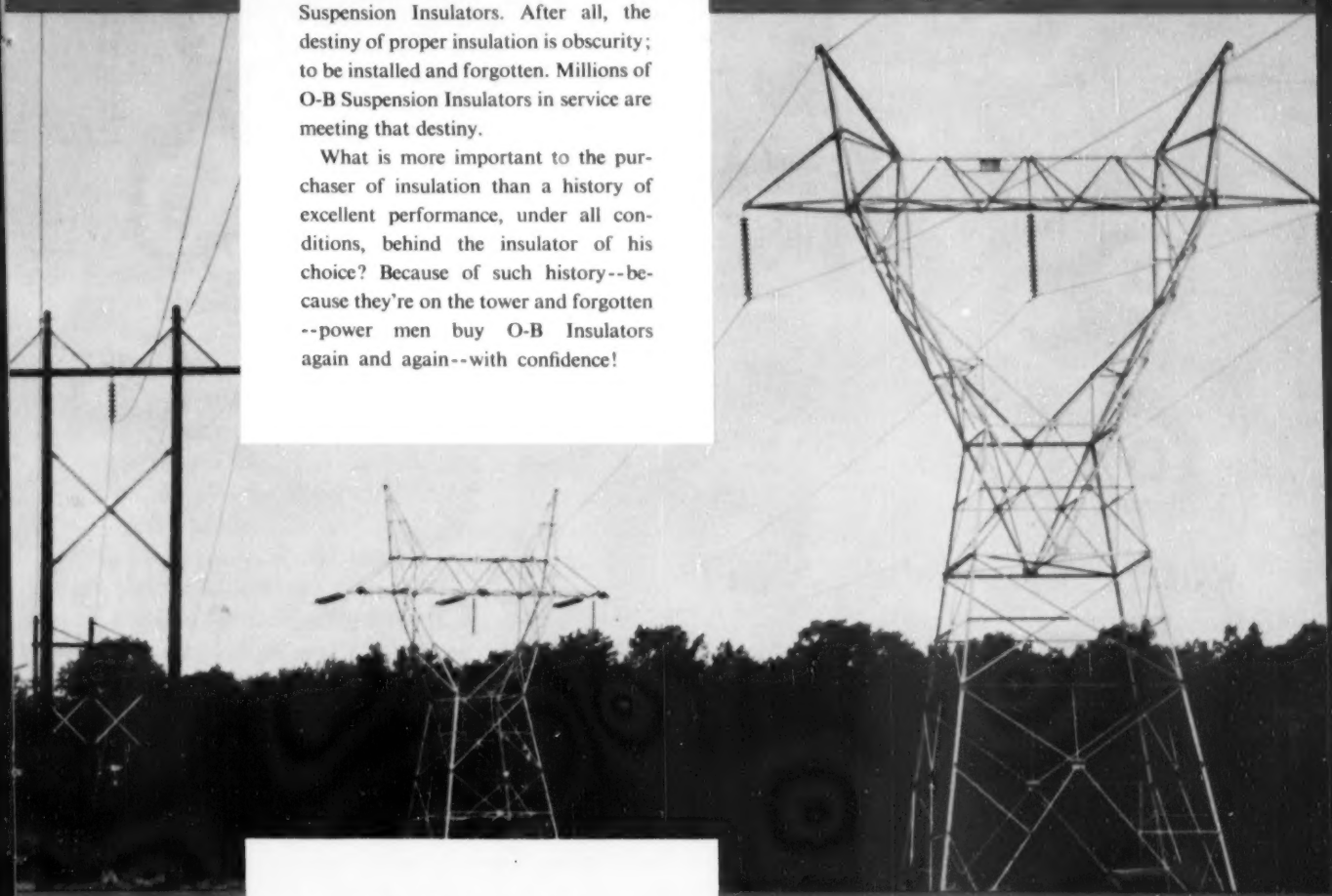
When contact is made with phase wire, the fuse will blow if line is hot. Because blown fuse is flipped from holder by spring steel, indication of hot line can be seen as well as heard.

TIME

Is the best insulator salesman

Years and years of uneventful service do more than anything else to encourage the repeated selection and use of O-B Suspension Insulators. After all, the destiny of proper insulation is obscurity; to be installed and forgotten. Millions of O-B Suspension Insulators in service are meeting that destiny.

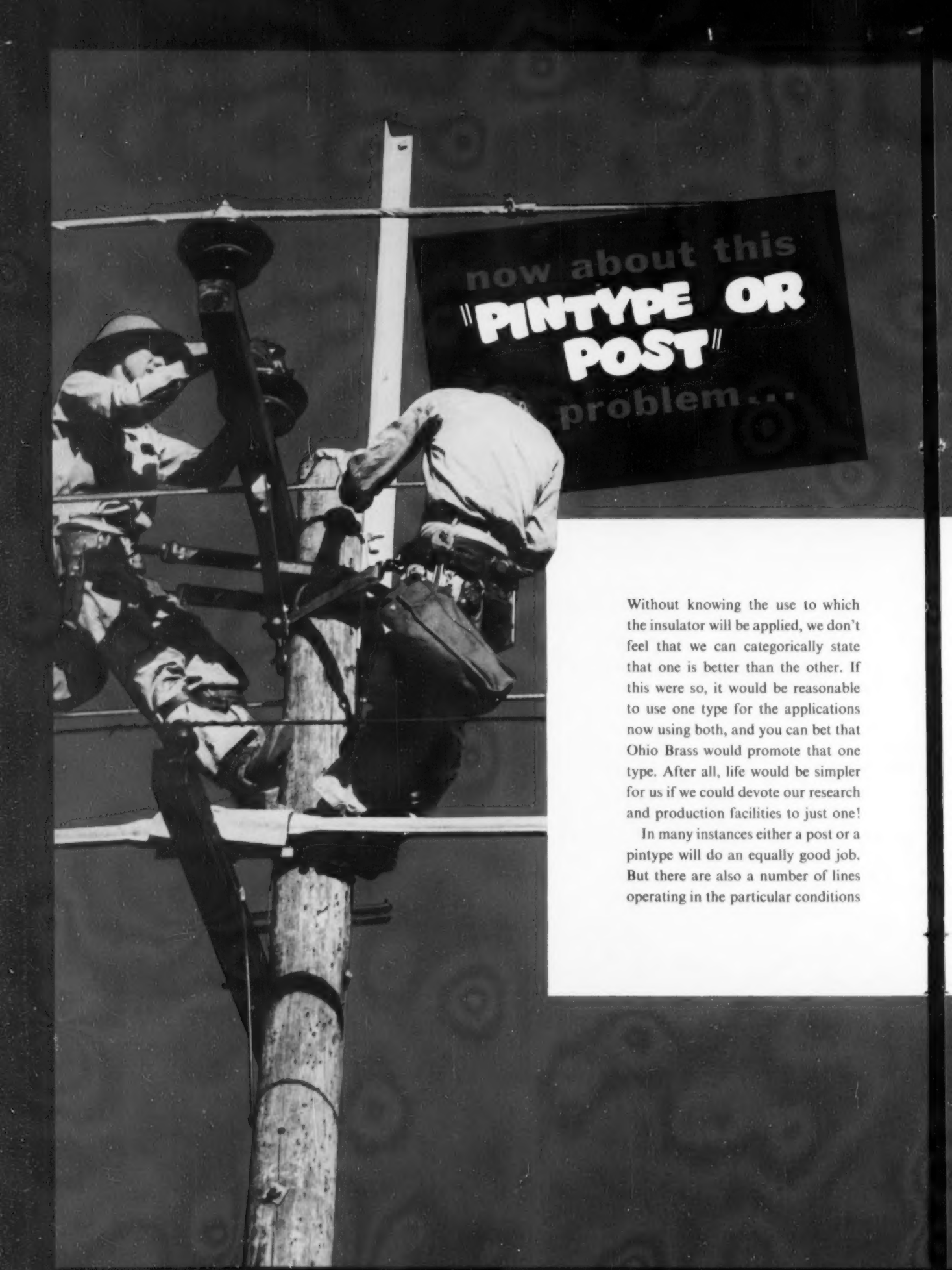
What is more important to the purchaser of insulation than a history of excellent performance, under all conditions, behind the insulator of his choice? Because of such history--because they're on the tower and forgotten --power men buy O-B Insulators again and again--with confidence!



A record of consistently good performance on this 110-kv line led to the choice of O-B Suspension Insulators--again--for use on the 220-kv line at the right.

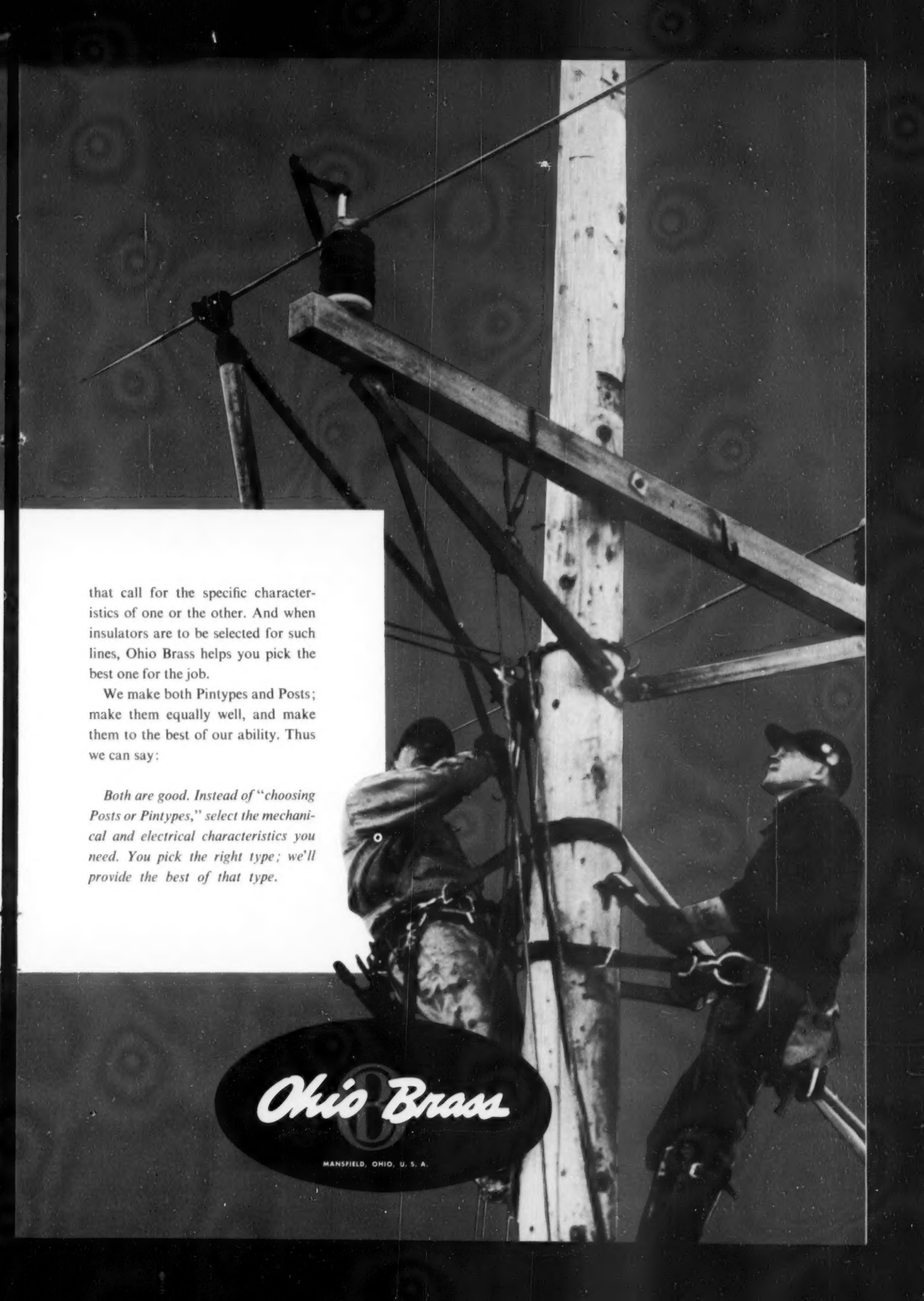
INVEST IN SERVICE CONTINUITY WITH Ohio Brass INSULATORS

MANSFIELD, OHIO, U. S. A.



Without knowing the use to which the insulator will be applied, we don't feel that we can categorically state that one is better than the other. If this were so, it would be reasonable to use one type for the applications now using both, and you can bet that Ohio Brass would promote that one type. After all, life would be simpler for us if we could devote our research and production facilities to just one!

In many instances either a post or a pintype will do an equally good job. But there are also a number of lines operating in the particular conditions



that call for the specific characteristics of one or the other. And when insulators are to be selected for such lines, Ohio Brass helps you pick the best one for the job.

We make both Pintypes and Posts; make them equally well, and make them to the best of our ability. Thus we can say:

Both are good. Instead of "choosing Posts or Pintypes," select the mechanical and electrical characteristics you need. You pick the right type; we'll provide the best of that type.

Ohio Brass

MANSFIELD, OHIO, U. S. A.

they've got what you want
WHEN YOU WANT IT!

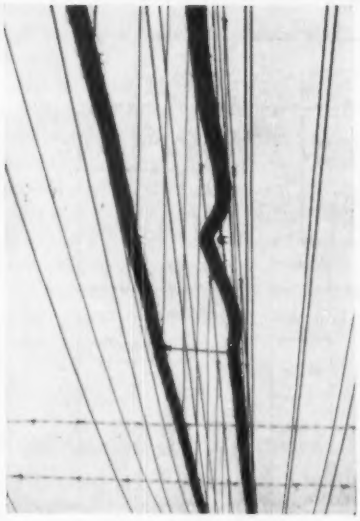
Constant readiness to serve is an outstanding O-B--Graybar service. With complete stocks of O-B distribution materials on hand at all times, you can depend on your Graybar dealer to make overnight (or shorter) delivery on hurry-up orders. And while you'll save several days by ordering through Graybar, you'll pay no more. There's no "Readiness-To-Serve" charge for keeping a complete line of O-B distribution materials stocked *close to the job.*

O-B works closely with over 100 Graybar warehouses to make sure that inventories are maintained at realistic levels. Depend on it: Graybar has--and will have--the O-B distribution materials you need when you need them!

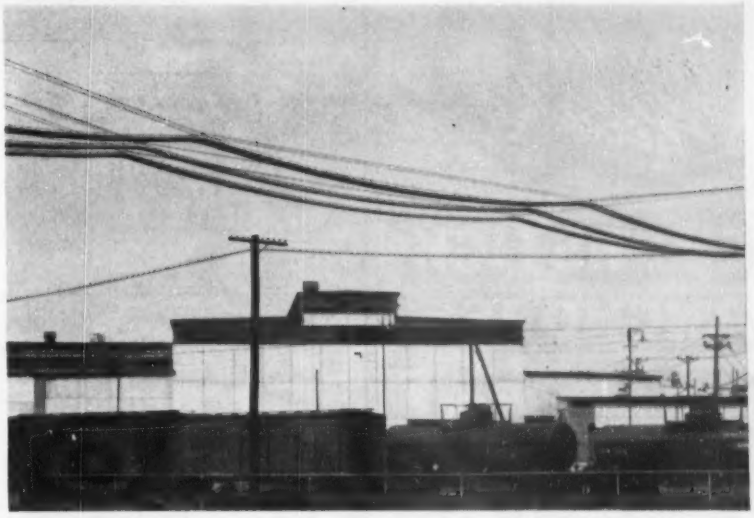
Ohio Brass

MANSFIELD, OHIO, U.S.A.

4426-H



SNAKING OF AERIAL CABLE resulted when 400-foot spans were installed from catenary



FEWER SUSPENSION POINTS in the span eliminated the problem of snaking and adds to appearance. It was feared that snaking would cause cable failure

Suspension Design Eliminates Aerial Cable Snaking

A new suspension design for long spans of aerial cable has eliminated cable snaking caused by expansion and contraction with temperature changes. Dow Chemical Co developed the design because of fear that cable fatigue might result from repeated expansion and contraction cycling.

The new design provides only two suspension points in spans up to 400 ft long in addition to the support points at the structures. Formerly, a catenary suspension scheme with numerous cable supports was employed, which resulted in cable snaking.

All recent 13.8-kv overhead distribution construction at the company's Midland plant is aerial cable. Fewer troubles from corrosive atmospheres, improved appearance, and fewer lightning troubles are some of the reasons for this design.

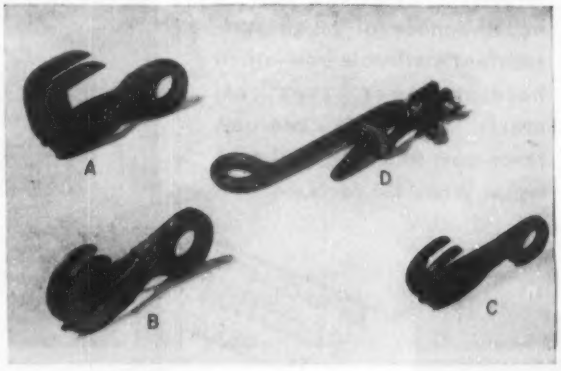
Hot-Line Tools Facilitate Deadending With 6-in. Disks

N. E. NEWKIRK, Atlantic City Electric Co, Bridgeton, N. J.

Two styles of hot-line tools, developed by Atlantic City Electric Co, are both practical and time saving for two different deadends. The tools are now furnished from an outside source.

One style of tool has three sizes. It is used with one type of deadend having a flexible clevis that attaches to a 6-in. disk or to different sized insulators. This style of tool is shown in the illustration—A for No. 2 copper, B for No. 4 and C for No. 6. Another illustration shows how this tool holds the deadend in place, so the wire is ready for insertion when blocks have pulled the wire to proper sag. After the wire has been inserted in the deadend, the tool is easily removed with a hot stick.

The other style of tool is designated D in the illustration. It is used with another type of deadend having a rigid clevis, rather than a flexible clevis. This tool holds the deadend in position to receive the wire much in the same manner as the other tools.



HOT-LINE TOOLS used with flexible clevises and rigid clevises

SIMULATED DEADEND positioned by hot-line tool (center)

The Old Reliable

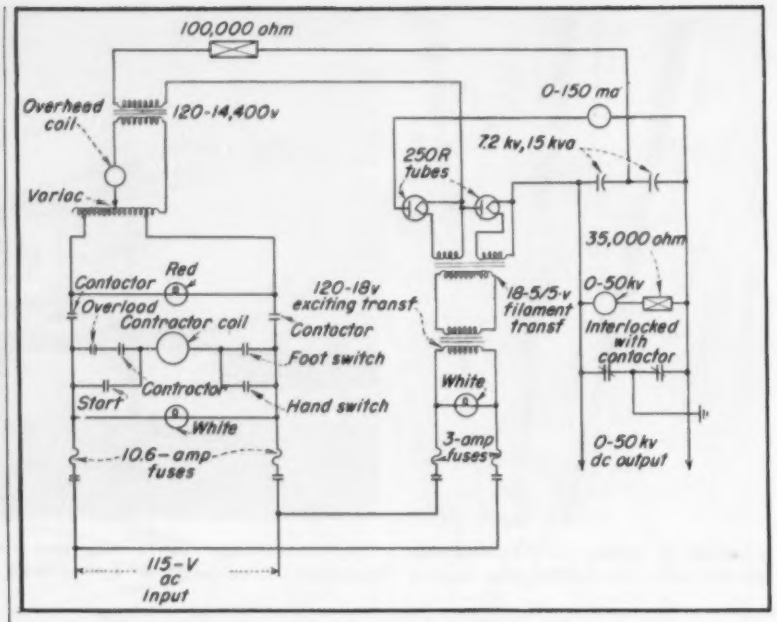
EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life

● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all others. Available two-way, three-way, four-way, and cone types. Write for facts.

Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO.
Manufacturer of "THE ANCHOR OF MERIT"
FAIRFIELD, IOWA

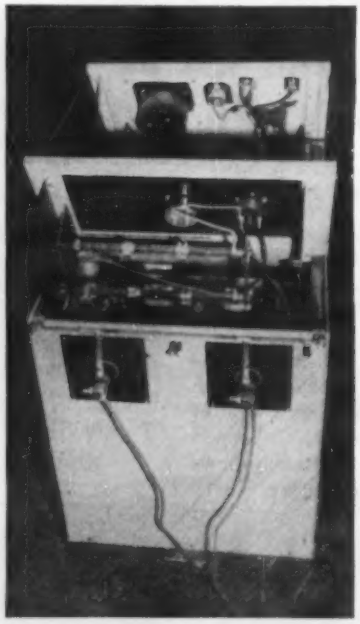


VOLTAGE DOUBLER CIRCUIT permits use of standard components throughout dc supply except for filament transformer. Latter is wound on 3-kw spiral core and insulated for 60 kv

50-Kv Dc Unit Tests Rubber Goods

R. L. MORTENSEN, Meter Dept, Sierra Pacific Power Co, Reno, Nev.

A portable 50-kv unit for high-voltage dc testing of rubber goods has been developed by Sierra Pacific Power Co. Because of its portability, the tester can also be used for other insulation tests. It was built by meter department employees for a material cost of $600.



TEST TERMINALS are grounded by metal leads on operating bar. Insulated push rod from contactor clapper actuates this bar

Major components of the unit include a 750-va, 14,400-120-v supply transformer; vacuum-tube rectifiers; 7.2-kv, 15-kva capacitors; a 10-amp 115-v variac; an 18-5/5-v filament transformer custom wound on a 3-kw spiral core insulated for 60 kv; and a 120-18-v doorbell transformer. Voltage doubler circuit used in the tester permits use of standard components throughout except for the filament transformer.

Equipment is mounted in a plywood box reinforced with angle irons. Fastened to the bottom are two swivel casters and one fixed caster.

Control and indicating switches and instruments are mounted on two hinged panels on top of the box. Panels are connected by chains so that they open and close together. A start button and a finger push button that provide double interlocking to prevent accidental energizing are mounted on the control panel. When the start button is pushed, either the finger push button or a foot switch, which are connected in parallel, will energize the high-voltage leads. Shorting contacts, mechanically inter-

locked with the contactor, short the high-voltage terminals when they are de-energized.

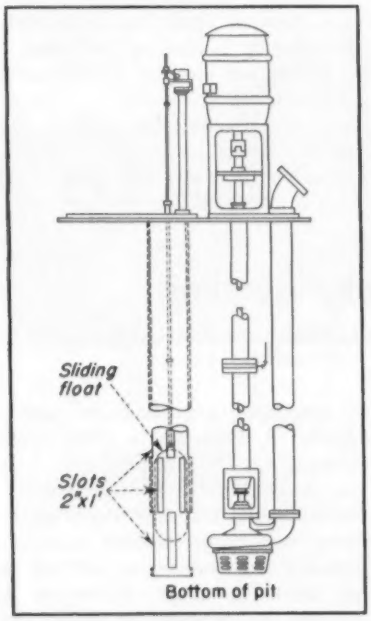
Other items on the control panel include switches for filament and plate supply, indicating lights, and a timer. A voltage control variac is also located on the panel.

On the instrument panel are mounted a 1-150-ma ammeter and a 1-ma voltmeter shunted to match a 35-megohm resistor to provide 50 kv at full scale. Static shielding for voltmeter was found necessary.

Pipe Guard Slots Prevent Sticking of Pump Floats

V. C. FAY, Foreman, Maintenance Dept, Tanners Creek Plant, Indiana & Michigan Electric Co, Lawrenceburg, Ind.

Slots cut in float chambers have eliminated failure of automatic starting of boiler room sump pumps. The modified float chambers have been in service over a year. Previously flyash accumulated in the pipe guards around the float and frequently prevented starting.



STAGGERED SLOTS cut in pipe guard prevent sticking of sump-pump float

Staggered 12 x 2-in. slots were cut in the pipe. Natural water movement in pits self-cleans float chambers. Staggering of the slots prevented excessive weakening of the guards.

as at the

ALBRIGHT STATION*

Monongahela Power Company
Fairmont, West Virginia

Units #1 and #2 are in operation. The fans for Unit #3 have been designed and are being constructed. They will be larger than the fans for the first two units. Boiler #3 will operate on the same type of fuel (pulverized coal) and is expected to generate one million pounds of steam per hour.

Each boiler now in service is served by two Forced Draft and two Induced Draft Fans with the following specifications:

F. D. Fans Double inlet with radial inlet vanes; outlet dampers; rain hoods and recirculating duct connections. Capacity for each fan: 110,500 cfm; 100 F; 14.7" SP; 1180 rpm; 348 hp.

I. D. Fans Double inlet, special control type inlet dampers and outlet dampers. Capacity of each: 187,000 cfm at 350 F; 13.5" SP; 880 rpm; 566 hp.

Green Fans can show an excellent record of efficiency and durability. They can be found in many of the leading and recently completed utility and industrial power plants. They have back of them a fund of knowledge about fan requirements and fan design. They serve their users well.

*Sanderson & Porter, Engineers

Our Catalog No. 168 tells all about Green Fans. Write for a copy.

THE GREEN *Fuel Economizer* COMPANY INC.

- Economizers
- Fans
- Air Heaters
- Cinder Traps
- Aerodyne Dust Collectors

BEACON 3, NEW YORK

INDUSTRIAL APPLICATIONS

PLASTIC SEAL DRYING time for glass replacement is cut to 4-5 min by heat lamps

Lamps Speed Window Replacement

CHARLES KELLY, Cambie Garage, B. C. Electric Co, Vancouver

Use of quick-drying heat lamps in replacing glass in bus windows is reaping savings in time, material and money at B. C. Electric Co's major overhaul depot, Cambie Garage. Savings in labor and material amount to between $400 and 500 annually. Time to seal glass in channel has been cut from 3-4 days to 4-5 min. Reduction in installation is especially important because it means less out-of-service time for buses.

Portable drying unit is made from sheet aluminum and measures 28 in. long, 14 in. high and 10 in. wide. Five standard 120-w, 110-v heat lamps are mounted at the top. Heat is used to effect rapid swelling of plastic material called Everseal between glass pane and aluminum channel.

Previously, Everseal was coated with motor oil so that it would swell to a tight joint. Because swelling took up to four days, one alternative was to use a fairly thick layer of Everseal and force channel onto glass with hammer. But this caused cracking of glass when Everseal swelled to full size after bus returned to service.

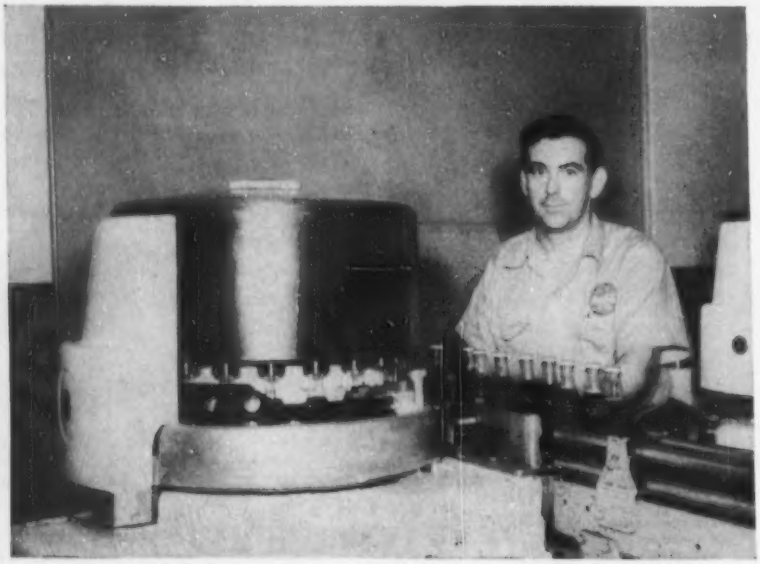
Experimentally, author used thinner layer of Everseal and let the sun speed the swelling, which reached a maximum within 40 hr. Sun drying also stopped subsequent cracking. Thus, use of heat lamps was a natural step.

About 350 glass panes have been replaced with lamps to date and not one has been cracked by continued swelling after leaving shop. Further saving may be realized on new channels, because many were previously damaged by hammering onto glass.

Drying box also has proved useful in quick-sealing handles on drivers' windows, which are replaced in the buses, and in removing old rubber carpeting from bus floors. Removal time was cut from 6 to 3 hr per bus.

Automatic Electronic Inspection Speeds Coke Bottling

L. ALBERTSON, Philadelphia Electric Co., Philadelphia, Pa.



INSPECTION MACHINE automatically rejects any bottle having foreign matter. It is more dependable and much quicker than visual examination

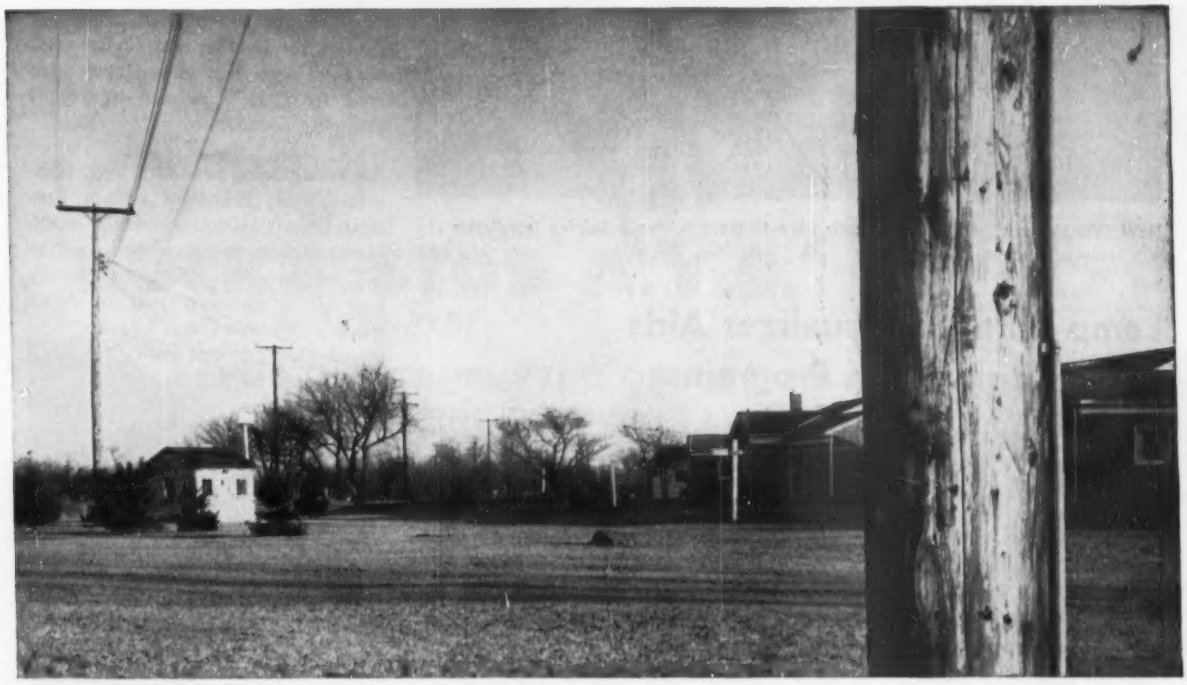
Automatic inspection of bottled drinks at Philadelphia Coca Cola Bottling Co., Philadelphia, Pa., with photo-electric tubes in inspection machines assures that only bottles which have successfully satisfied rigid inspection requirements are allowed to go out to the trade. Production is speeded up because machines give quicker action and are more dependable than visual examination.

The machines inspect bottles after operations of filling, mixing, and crowning have been completed and will reject any bottle in which foreign matter appears. Marked bottles are sent through each machine periodically to check its accuracy. Inspection machines are constructed to fit bottling lines and may be regulated to handle 60 to 150 bottles per minute.

DOW

PENTA-TREATED POLES MAKE GOOD NEIGHBORS

Detroit Edison builds for the future and for its customers with clean, treated poles



The Dow Chemical Company
Dept. PE-1857-RB Midland, Michigan

_____ Send me free booklet, "Pointers on Penta".

_____ Send me list of PENTA treating plants.

Name_____

Title_____ Company_____

Address_____

City_____ State_____

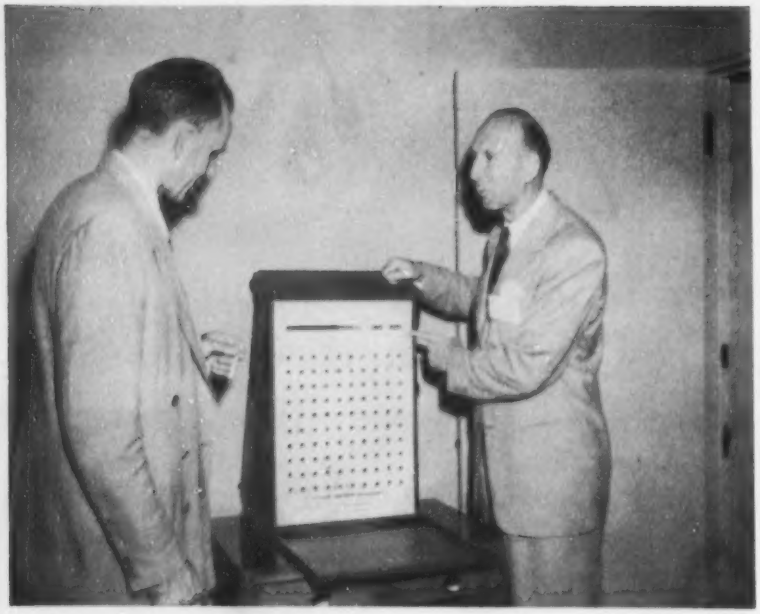
Looking for a *good neighbor policy?* Specify *clean*, full-length PENTA* treatment for all utility poles.

Over the years, PENTA-treated poles have been doing double duty for the Detroit Edison Company. In residential areas these poles are doing their share in maintaining good customer relations because they are clean, attractive—fit well in modern settings. They are also keeping repair and replacement costs at a minimum by resisting decay and termite damage. PENTA-treated poles last many years.

Over 60 suppliers across the nation can furnish you with PENTA-treated poles. Be sure to ask your regular supplier about *clean* *PENTAchlorophenol or write THE DOW CHEMICAL COMPANY, Midland, Michigan.

you can depend on DOW CHEMICALS

DOW



NEW "VISUALIZER" shows automatically when to group relamp a lighting installation

Lamp Burnout Visualizer Aids Group Relamping Programs

Planned group relamping is made more easily understood by this "Lamp Burnout Visualizer" developed by the General Electric Co.

This new demonstration tool, designed to be used in the field by GE Lamp Division Sales District personnel, shows automatically when to group relamp a lighting installation, thereby reducing the maintenance cost, providing a better appearance, reducing work interruptions and providing more light at less cost. Picture shows J. C. Forbes (right), Manager of GE's Lighting Institute at Nela Park, demonstrating the "Visualizer" to D. W. Frick, Canadian Broadcasting Corporation.

Blast Freezers Preserve Food Color

Fast freezing of turkeys, poultry, meat and other perishable foods at Cincinnati Terminal Warehouses, Inc, Cincinnati, Ohio is accomplished by three recently installed banks of blast freezers. The foods are quickly frozen to keep them from changing color.

Each blast freezer consists of a bank of tubes through which brine at 26 to 30 F below zero is circulated. Several motor-driven blowers direct a high velocity air blast across tubes and temperature of air is lowered to approximately 16 F below zero. The turbulent air blast at this low temperature directed upon food results in it being frozen stiff very quickly. Each blast freezer is enclosed with a protective housing.

Two of the freezers are each powered with a 10-hp, 480-v, 3-phase, motor-driven blower. Third freezer is powered with a 20-hp, 480-v, 3-phase, motor-driven blower. Reliability of service is of prime importance because failure of refrigeration equipment for any reason would cause loss of large quantities of frozen foods worth thousands of dollars.

Refrigeration plant consists of three motor-driven compressors, each having a 135-hp, 480-v, 3-phase, 100-rpm, synchronous motor. These synchronous motors also serve to furnish leading reactive kva and help correct overall power factor which is maintained at 90%. L. J. Langevin, Power Engineer, Cincinnati Gas & Electric Co.

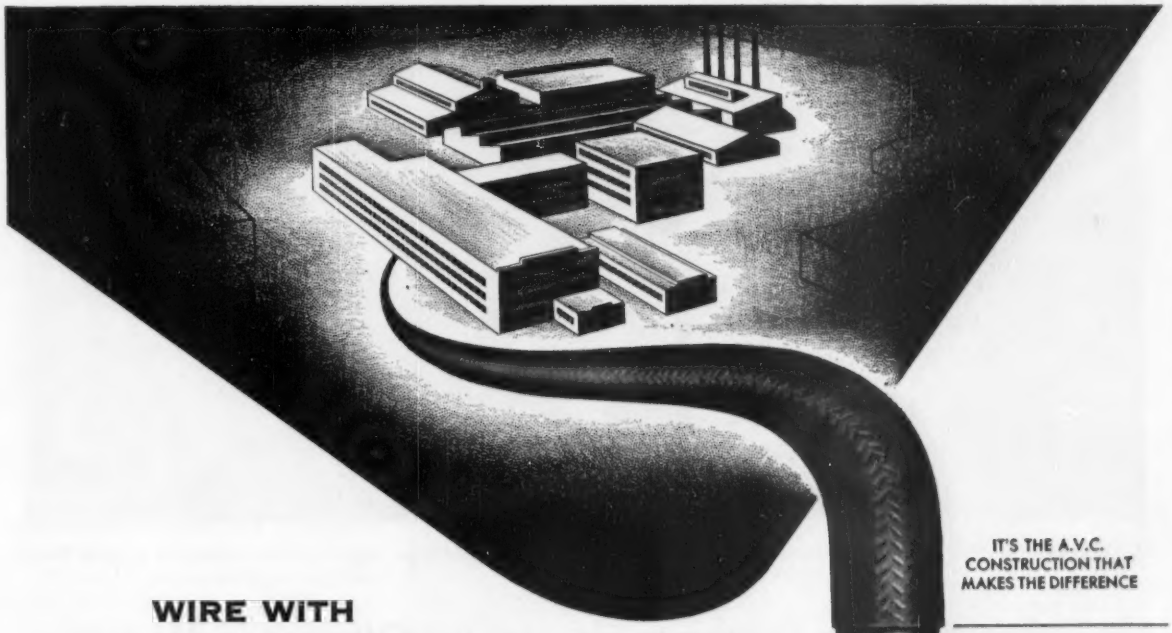
INDUSTRIAL BRIEFS

Conversion to 480-v delta of 4-wire, 120/240-v, 3-ph system at American Felt Co, Greenwich, Conn. permitted addition of 100 kva of new equipment and use of existing feeders which were inadequate to meet increasing manufacturing requirements. Service switch was overloaded to a point where 95% power-factor had to be maintained to keep current low enough for continuous operation. Feeders had no spare capacity. Conversion included air-type transformers at single-phase load centers for lighting and single phase loads. Larger motors are now operated from 480-v service by simply changing connection.

Air conditioning new 4200-sq ft addition to Gray Printing Co Plant, Fostoria, Ohio provides comfortable working conditions for plant personnel as well as humidity control. Company first air conditioned part of office space a few years ago and has continued adding to this installation until entire plant as well as office is now completely equipped. Entire installation totals 60 hp. O. J. Rose, Commercial Rep, Ohio Power Co, Fostoria.

Heating water with 15-kw automatic heater replaced a coal-fired jack stove for shower and washroom of welding shop at Lummus Co, Luzerne, Pa. Unsightly coal and ash piles and dirt and dust associated with jack stove have been eliminated. Employee relations have improved since hot water is now available at all times. Labor costs of tending fire are saved. Charles Miller, Industrial Power Rep, Pennsylvania Power & Light Co.

Modernization of plant distribution system at The Montgomery Co, Windsor Locks, Conn. with prefabricated bus duct facilitates conversion of 82-yr old factory for multi-floor varied and intensified production. Diversified metal products, including yarns and tinsels demanded more circuits and flexible machine layouts to aid fast changeovers. To offset reduced capacity of enclosed riser duct, a 1,350-amp riser bus was installed to insure 1,200-amp delivery. Branch circuits fed from tee connections farsightedly provided on main riser at each floor, sped distribution improvement without production shutdowns.



WIRE WITH

ROCKBESTOS A.V.C.®

(N. E. C. TYPE AVA)

FOR UNINTERRUPTED OPERATION, REDUCED BREAKDOWNS, LOWER WIRE MAINTENANCE COSTS

IT'S THE A.V.C. CONSTRUCTION THAT MAKES THE DIFFERENCE

OUTER FELTED ASBESTOS WALL

VARNISHED CAMBRIC

INNER FELTED ASBESTOS WALL

You can get life-long dependable service under severe operating conditions because these walls of impregnated felted asbestos permanently resist heat and moisture, mechanical damage and effectively seal the high dielectric varnished cambric tapes from deterioration.

If HEAT is your problem — Rockbestos A.V.C. (NEC TYPE AVA) is your answer to costly power failures and maintenance down time.

Rockbestos A.V.C. Power, Lighting and Control Cables are designed primarily for installation in high ambient locations and to withstand additional operating hazards such as grease, oil, chemicals and corrosive fumes.

Their dense felted walls of thoroughly impregnated asbestos form a continuous insulation to protect the varnished cambric tapes inserted between the walls of asbestos for higher dielectric strength and added moisture resistance.

Plant layouts and expansion programs are given greater flexibility by installing Rockbestos A.V.C. because not only does it provide greater current carrying capacity for emergency demands and future load growth in existing circuits, but the installation of heat generating equipment is not restricted by its nearness to vital electrical circuits.

Write for the booklet "CUTS CABLE COSTS" which lists the practical advantages of ROCKBESTOS A.V.C. for industrial applications in severe or unusual operating conditions.

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CONTROLLING GROWTH of chrysanthemums and daisies uses about $1 worth of energy per night per acre. Total load is about 60 kw

Nighttime Lighting Produces Flowers for Off-season Market

HAROLD HALL, Lighting Consultant, Southern California Edison Co, Whittier

Control of the "photoperiod" through use of nighttime artificial lighting allows the Loma Flora Co, Whittier, Calif., to market chrysanthemums and Shasta daisies in the off season and at better prices. Total installed lighting load of Loma Flora is almost 60 kw, consisting of 12 acres of flower beds with 270 100-w bulbs per acre. Load period is from 8 pm to 12:30 am every night from August until May. Total operating cost to Loma Flora is about $1 per acre per night.

After consulting with state and federal agriculture agencies in California, it was found that lighting in addition to normal daylight makes daisies flower earlier and chrysanthemums later than normal. Problem was to design a lighting system to illuminate an acre of plants about four hours per night.

Installation consists of light bulbs strung from open wire on rows of poles with 14 ft between rows. Bulbs are mounted 6.5 ft high and 12 ft apart.

Light intensities to obtain desired results were found to be a minimum at 1 and a maximum at 5 ft-c. Installation is designed to produce a midpoint average of 2.5 ft-c minimum and 3.5 ft-c maximum.

Original layout recommended the use of bulbs with a shallow-dome reflector.

However, customer decided not to buy reflectors but to install 100-w unshaded bulbs instead. Lighting is arranged so that two acres may be illuminated while another two stand by for soil conservation. Loma Flora has three such installations in place at the present time. Three other customers of Southern California Edison have similar installations with which they are very pleased.

Florida Power Opens Lighting Center

A combined office and home lighting demonstration center, incorporating the most modern techniques of light conditioning, has recently been completed by Florida Power Corporation. Located in the company's main office building in St. Petersburg, the new center is designed to help promote better home lighting. A remote control switchboard is used to show home-makers, builders, architects, etc. the beauty and efficiency of modern light conditioning. Mrs. Amy Thompson, home service director, is operating the board.

Electric Heating . . .

. . . shows big increase among customers of Electric Power Board of Chattanooga

Increase in electric house heating among customers of the Electric Power Board of Chattanooga is much faster this year than last. During the first nine months last year a total of 1,813 homes went to electric heating, an increase of 14.5% over the same period last year. This included 1,284 new houses and 529 conversions to electric heating. About 20 large central air-conditioning units have been installed.

Figures for September show that 386 new electric house heating jobs were completed, of which 242 were conversions from coal, gas or oil. The total included 26 homes installing radiant heating, 214 floor furnaces and 144 homes with individual room heaters. The load totaled 4,907 kw with estimated annual revenue of $32,706.

In August there were 227 installations completed of which 24 were radiant heating, 115 floor furnaces and 86 individual room heaters, one central unit and one steam-electric furnace. The connected load was 2,913 kw and the estimated annual revenue totaled $18,937.

ELECTRIC HEATING CABLE will keep swimming pool deck and air above at comfortable temperature year round at Phoenix lodge. Three individual circuits are fed from 240-v supply

Putting Some Heat in Cold Concrete

Electrically heated swimming pool deck representing 68 kw of load is unique feature of Town and Country Lodge in Phoenix, Ariz. Thermostatic control will hold 5,000 ft of deck surface at comfortable temperature the year round. System is said to heat air above deck to a height of 7 ft.

More than 22,000 ft of heating cable of ⅛-in. diameter and with neoprene insulation were used in system surrounding 60x60-ft pool. Three single-phase circuits take power from a 240-v, three-phase supply. Each circuit has its own thermostat.

Heating system was installed by Arizona Building Contractors Club, which operates in conjunction with the lodge.

Load is served by Arizona Public Service Co, which believes this is first heated deck in Southwest.

Georgia Power Gives $25,000 for 4-H Building

A $25,000 farm electrification building, a gift from the Georgia Power Co, will be constructed at the Georgia 4-H Club center which is being developed at Rock Eagle Park near Eatonton. The building will house electrical equipment to be studied by 4-H boys and girls as a part of their educational program.

Harllee Branch, Jr, president of the power company, said the farm electrification building will be named in honor of Charles A. Collier, vice president and director of the company and a veteran of 44 years of service.

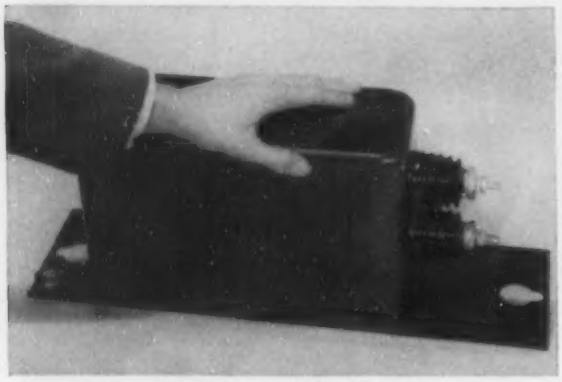
Collier pioneered the company's farm electrification program and was responsible for its policy of cooperation with the 4-H Clubs and other farm groups.

'54 Appliance Promotions Announced by EEI

Two new campaigns for promoting electric ranges and electric water heaters on a coordinated industry wide basis in the spring of 1954 have been announced by the residential promotion committee of Edison Electric Institute. The major effort in the range promotion will be concentrated in April. Using "Spring Showing" as the theme and incorporating an adaptation of the new industry slogan "Be Modern—Live Electrically," the committee has prepared three special promotional items—a colorful window display, a consumer folder and a gift bond blank to be used by dealers in obtaining prospects for range sales.

For the water heater program, the month chosen for the greatest concentration of effort is May. For this program the theme "Get Rid of Your Old Fashioned Water Heater" was selected and is featured in the display material especially prepared for the promotion. In addition to the display kit, a consumer folder stressing eight reasons why electric water heaters are best has been produced. Edison Electric Institute also has available for electric water heater promotions a movie, a set of slides, two booklets and a radio spot transcription, all of which can be easily incorporated into any local or national campaign.

NEW EQUIPMENT



Secondary Capacitor

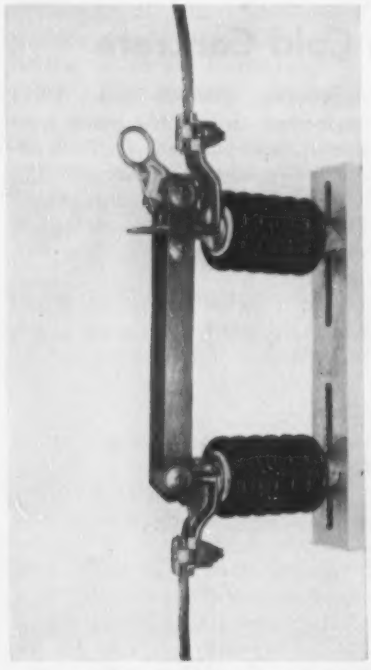
A new residential secondary capacitor is rated single-phase, 5 kva, 240 v. It is said to feature low installed cost per kva, long life, a ground stud for easy grounding, and a durable triple-coat finished case.

The hermetically sealed, Pyranol filled case provides necessary characteristics for expansion due to temperature changes. It can be mounted on the pole, or crossarms with the bushings pointing up or down.

General Electric Co, 1 River Rd, Schenectady 5, N. Y.

Line Switch

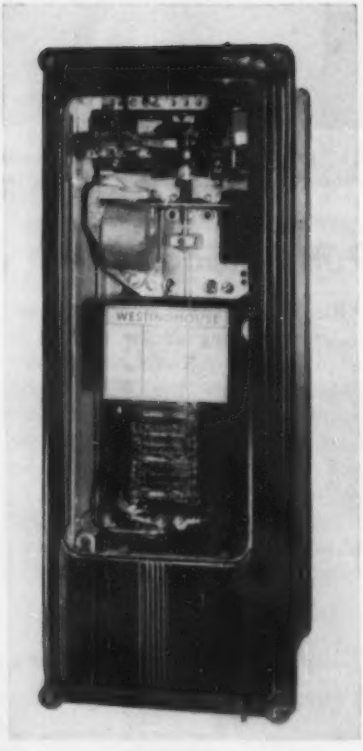
A new single-pole, single-throw hook operated switch is designed for wood crossarm mounting in vertical and underhung positions. The Type PH is available for 7.5 and 15 kv and



in continuous current ratings of 200 and 400 amp.

Features claimed for the switch include high-pressure contacts, positive latching, parallel blade construction, integral terminals, and blade pry-out action.

Southern States Equipment Corp, Hampton, Ga.



Overcurrent Relay

A new negative-sequence overcurrent relay, Type COQ, initiates action to remove a generator from a faulted line when the negative-sequence current approaches the maximum allowed. In the COQ, a negative-sequence current filter with output proportional to the input operates an overcurrent relay which initiates tripping of a breaker.

The relay has taps at 3, 3.25, 3.5, 3.8, 4.2, 4.6, and 5 amps, 60 cps. Tap value corresponds to current received from the auxiliary transformer secondary. Relay characteristics are matched to generator characteristics by means of eight time dial settings.

Westinghouse Electric Corp, P. O. Box 2099, Pittsburgh 30, Pa.

Current Transformer

A new butyl-molded current transformer, Type JKW-3, is applicable for outdoor installations up to 5,000 v. Its entire exposed surface is completely corrosion-resistant and should reduce maintenance to a minimum, it is claimed. Possible bushing breakage is said to be reduced to a minimum by use of butyl. There are no gaskets

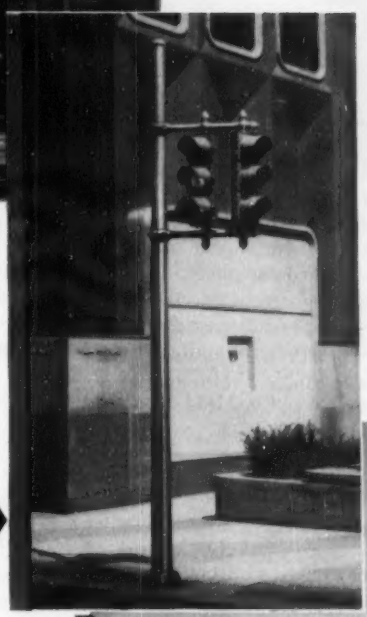
and welds because the bushing and case form a homogeneous whole.

A secondary terminal box is molded in the case as an integral part of the transformer and an aluminum cover provides water-tight protection. Primary coils are of the figure 8 type to

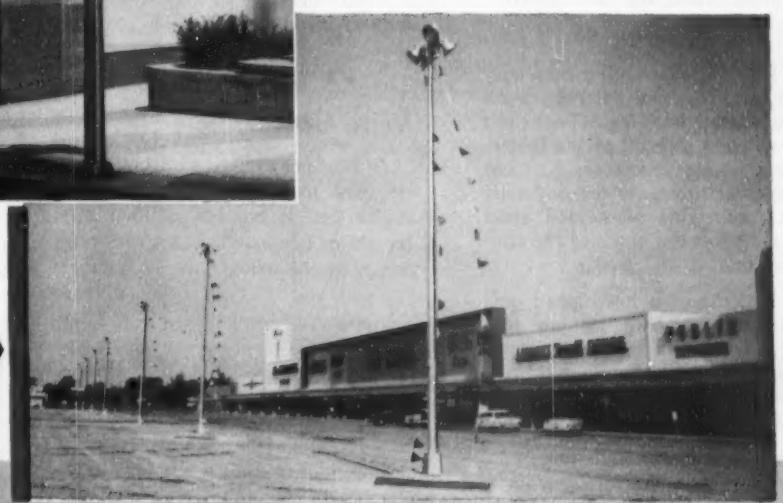
HAPCO Aluminum Alloy Standards

for Street Lights Traffic Lights Flood Lights

A New England city chooses this Hapco Standard and Bracket with special features including a festoon outlet used as a plug for a photo-electric cell.



A Hapco Aluminum Alloy Standard with traffic lights harmonizes with the world's first building with all-aluminum exterior walls.



A parade of Hapco Standards with floodlights illuminates a new shopping center in the sub-tropical South.

The urge for civic beauty is dotting the map everywhere with attractive Hapco Aluminum Alloy Standards and Street Lighting Brackets.

Hapco Aluminum Alloy Standards retain their original lustrous beauty, untarnished by atmospheric conditions. Long life with a complete lack of maintenance requirements guarantees a minimum overall cost. Hapco gracefully tapered standards have equal wall thickness and uniform strength throughout. Their high visibility helps to reduce accidents. Their light weight — about one-third that of steel — makes them easy to handle, easy to erect. Available in seamless lengths up to 40 feet—adaptable to any type of internal or external circuits.

HUBBARD ALUMINUM PRODUCTS COMPANY

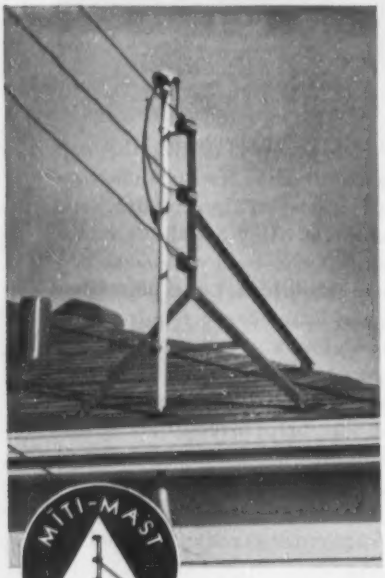
MANUFACTURERS OF HAPCO QUALITY ALUMINUM PRODUCTS

A Division of HUBBARD and COMPANY

6301 Butler Street • Pittsburgh 1, Pa.

New, Practical SERVICE MAST

Meets Code Requirements



PACKAGED UNIT

Installed by one man in minutes

MITI-MAST is a low cost, easy to install service entrance mast for all low buildings. Each unit is shipped with all of the heavy-duty fittings necessary to meet code requirements for any type of roof. This all-welded steel mast takes the place of the conventional 4"x4" post.

Entire unit is hot dipped galvanized for long trouble free service. Available with any combination of fittings to meet any specific installation requirement. Fits any type roof.

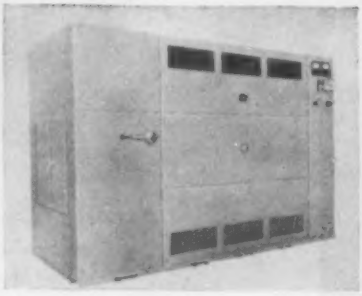
Low first cost . . . low installation cost.

Investigate—get the important facts. Catalog sheets and prices on request.

UTILITY SERVICE CO., INC.
921 - 13th STREET
RACINE, WISCONSIN

provide a high degree of mechanical strength. Low core losses and high accuracy are said to result from the interleaved, high-permeability silicon-strip steel core.

General Electric Co, 1 River Rd, Schenectady 5, N. Y.



Load Center

A new unit load center featuring built-in automatic forced draft equipment to increase capacity under overload conditions is rated 2,000 kva, 4,800-480 v, 60 cps, three phase. The unit is packaged with fused load break air switch on primary side, and secondary metering and pull section. Primary switch handle and access door are interlocked for safety.

The transformer features class B high-dielectric, high-heat magnet wire insulated with Quinterra and Mylar polyester film.

Marcus Transformer Co, 32-34 Montgomery St, Hillside 5, N. J.

Wire Cutter

A new emergency wire cutter can be used to safely cut wires up to 4,800 kv. It consists of two 6 ft lengths of laminated sitka spruce pole, which can be joined easily, a cutter at one end, and a double pulley and rope for operating the cutting blade. Tremendous power, from the pulley and compound lever, ease of operation, and light weight are features claimed for the cutter.

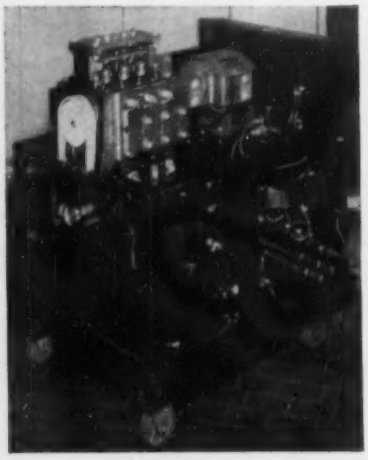
Bartlett Manufacturing Co, 3003 E. Grand Blvd, Detroit 2, Mich.

Mechanical Rectifier

A new mechanical rectifier unit substation for transformation of ac to dc is said to feature stable operation and long contact life. It has an efficiency of more than 96%, including losses in transformers, switchgear, and other equipment.

Equipment is completely metal-enclosed and compartments have drawout facilities for easy inspection. Standard metal-clad switchgear controls the ac power supplied to the rectifier. Protection for dc circuits is provided by single-pole air circuit breakers. Units are available for providing up to 12,000 amps at 250 v and up to 6,000 amps at 500 v.

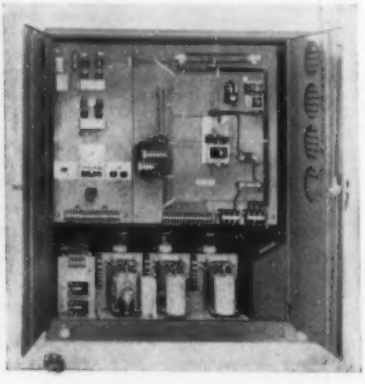
General Electric Co, 1 River Rd, Schenectady 5, N. Y.



Power Drive

A new mercury rectifier variable-voltage power drive is designed for applications requiring 30, 40, and 50-hp adjustable-speed motors. It consists of an operator's control station, a dc motor, and a control unit.

Control unit incorporates six single-anode, air-cooled mercury tubes operating from a three-phase power sup-



ply with a full-wave bridge. Each tube is arranged as a unit with its respective saturable reactors, magnet, and exciting bank, and is well shielded. Tubes are grid controlled by an electronic phase-shifting circuit. Ease of control and rapid response are secured through a current limit control.

Rectifier is enclosed in a cabinet with a louver opening for exhausting cooling air. Pan-type doors, front and back, are removable. Power connection is made through circuit breaker, which is mounted along with meters at one end of the cabinet.

Reliance Electric & Engineering Co, 1088 Ivanhoe Rd, Cleveland 10, Ohio

Coming New Equipment

Received Too Late for This Issue

Disconnect Switch

James R. Kearney Corp—Has rotating insulators with side break action

Service Mast

Utility Service Co—Extends 12 ft off the ground for temporary services

Phase Sequencer

Brunswick Instruments—Assures proper rotation when connecting motors

Voltage Indicator

Industrial Devices, Inc—Has two lamps to show when voltage is high or low

Dust-Tight Panels

A new line of dust-tight circuit breaker lighting and distribution panelboards is said to prevent entrance of grain dust, carbon black, coal or coke dust, and metal dust. They meet National Electrical Code requirements for and are approved by Underwriters for use in Class II, Groups E, F, and G hazardous locations.

Enclosure consists of a formed steel box and front with welded corners and heavy garlock packing between the front and box. Conduit hubs are seam-welded to the top or bottom of the enclosure. External, dust-tight handle mechanisms operate the branch circuit breakers.

Circuit breakers are thermal magnetic, quick make, quick break, and for ac and dc service. Lugs only or

Direct, accurate measurements of signal components—15 to 500 kc

Model 121 Wave Analyzer

This new Sierra Wave Analyzer is designed to give you maximum operating ease, high accuracy and broad applicability in analyzing complex wave forms between 15 and 500 kc. The instrument is particularly useful for carrier system frequency analysis and induction studies, for determining filter transmission characteristics, or for measuring distortion and intermodulation components of rf signal sources and transmitters.

The Model 121 makes possible direct measurement of signal components throughout its range, and eliminates complex expensive setups with conventional receivers and signal generators. Input level range is + 42 to — 70 dbm at 600 ohms impedance. Measuring accuracy is ± 2 db; selectivity is such that response is 45 db down at 1 kc off resonance. Input bridging impedance is 10,000 ohms in the pass band.

Model 122 LINE-BRIDGING TRANSFORMER

The Sierra 122 Line-Bridging Transformer instantly converts Model 121 Wave Analyzer from single-ended to balanced input. The transformer is a broad band ferrite core unit operating flat within 0.5 db. from 15 to 500 kc. It is compensated so that Analyzer readings are corrected for the transformer's small insertion loss. Offered in three impedances: Model 122A, 135 ohms; 122B, 500 ohms; 122C, 600 ohms.

For complete information see your local Sierra sales representative or request Bulletin 103A

sierra

Sierra Electronic Corporation

San Carlos 2, California, U. S. A.

Sales representatives in major cities

Manufacturers of Carrier Frequency Voltmeters, Wave Analyzers, Line Fault Analyzers, Directional Couplers, Wide-Band RF Transformers, Custom Radio Transmitters.

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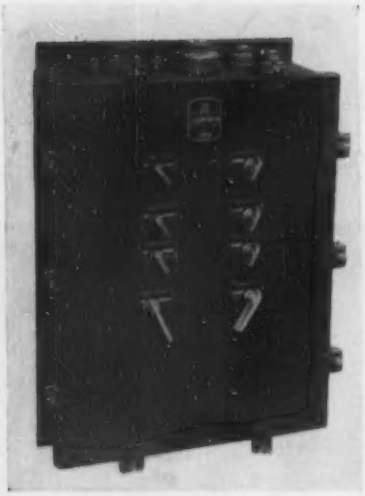


main circuit breaker construction is available. Branch circuit breakers are rated from 15 to 50 amp, single pole, and 15 to 100 amp, two pole and three pole.

Square D Co, 6060 Rivard St, Detroit 11, Mich.

Hook-On Meter

A new portable recording instrument suitable for indoor and outdoor applications obtains a permanent record of ac voltages and currents. It consists of a hook-on current transformer, a connecting lead, and an inkless recording combination voltmeter and ammeter.

The current transformer provides ranges from 15 to 750 amp and is suitable for conductors up to 2 in. in diam. Voltage ranges are 0-150/300/750 v. Overall accuracy is 3% of full scale, except on measurements above 625 amp on the 750-amp range where it is 4%.

General Electric Co, 1 River Rd, Schenectady 5, N. Y.

Motors

A new line of protected and enclosed motors is available in NEMA frame sizes 182 and 184, (1, 1½, and 2 hp). Features claimed for the motors include new insulating materials, good ventilation and heat transfer, efficient electrical design, and protected bearings.

Reliance Electric & Engineering Co, 1088 Ivanhoe Rd, Cleveland 10, Ohio

Nickel Cadmium Battery

A new nickel cadmium battery has sintered type plate construction. Features claimed for the battery include small size, long life, operation in any position, impervious to shock, can be left indefinitely in state of complete discharge without damage, will work in temperatures from 165F to −65F, and requires a few drops of water a year.

Good characteristics of the battery are said to be due to the sintering construction of porous plates. Active forms of nickel and cadmium are deposited in microscopic pores electrochemically. Electrolyte is potassium hydroxide.

Large currents can be drawn from the battery because of its low internal resistance. Starting from a completely discharged battery, a full charge can be obtained in a half hour. Under controlled charging, gassing can be reduced to a point where it is absorbed and reconverted into water. Gassing does not occur during standing and discharging, it is claimed.

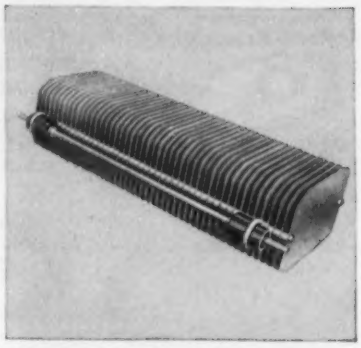
Sonotone Corp, Elmsford, N. Y.

Tachometer

A new hand tachometer has a thumb operated range selector for changing the scale numbers for each range and bringing into view the correct number of rpm per scale division. The long scale is sub-divided for maximum readability. Other features include high accuracy, long life, low operating torque, rapid response,

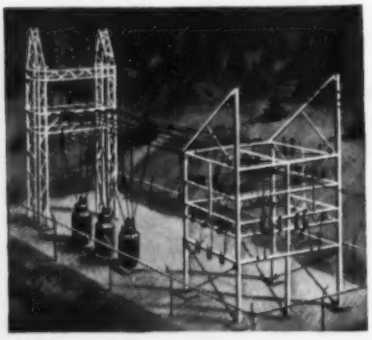
Advertisement

Electrical Applications of Aluminum



Lightweight Collector Plates

Collector plate assemblies for electronic air filters offer definite advantages when aluminum is used in their construction. For example, lightweight aluminum makes it easy to remove collector plates for cleaning and recoating—a distinct sales advantage over conventional heavyweight filter plate materials. Also, the light weight of aluminum permits easy lifting and precision alignment of the assemblies in manufacture. While not an adsorptive itself, aluminum readily lends itself to a process of slight etching which provides a capillary surface for the retention of a heavier film of oil which traps impurities out of the air. This process tends also to round the edges of the plates which reduces electrical losses in the filter.



Savings in Substations

Important savings in erection costs and maintenance are prime reasons for the growing popularity of aluminum substations with utilities and large industrial users. The light weight and easy fabrication of aluminum permits faster, simpler erection. More shop assembled aluminum components mean less assembly at the job site—less skill is needed in assembly and anywhere from 3 to 7 days can be cut in erecting an average substation. Maintenance costs are kept to a minimum because aluminum requires no painting—no costly shut-downs.

Write to Reynolds for details on the subjects above and also for details on the many other applications of aluminum in the electrical field.

REYNOLDS ACSR and REYNOLDS ELECTRICAL ENGINEERING SERVICE both ON THE JOB WHEN NEEDED

When field consultation is desired, Reynolds engineers are available to meet with your construction engineers right on the job site. There are many examples of this part of Reynolds Electrical Engineering Service. For instance, a Reynolds engineer recently assisted an Oklahoma company* in stringing conductor and overhead ground wire over a difficult river crossing. Another Reynolds engineer worked with a Kansas company* advising the contractor on correct ACSR stringing practices. In a third case, a Reynolds engineer went out on the job for a Missouri company* to review stringing practices and to advise engineers regarding cable behavior under various service conditions. These are typical of the countless on-the-job service calls made by Reynolds engineers.

The experienced help of Reynolds Electrical Engineering Service is available without cost to Reynolds cable customers. This service, plus the savings in original cost, handling costs and field costs offered by Reynolds ACSR, make a combination that is well worth looking into. *Remember—Reynolds engineers will also be glad to conduct a meeting with your men and present design and fabrication information on all phases of electrical application for aluminum.*

*Names on request

ACSR MANUAL FOR ENGINEERS CONTAINS COMPLETE BASIC INFORMATION, CHARTS AND TABLES. This book is available without charge when requested on your business letterhead.

For information on specific problems see your Reynolds distributors listed below, call the nearest Reynolds Office or write direct. Reynolds Metals Company 2584 South Third Street, Louisville 1, Kentucky

A. A. Electric Supply, Chicago • California Electric Supply, San Francisco
General Electric Supply Co., Bridgeport (and branches) • Gough Industries, Los Angeles
Hendrie & Bolthoff, Denver • Hughes Electric Supply, Orlando
The Karsmeyer Co., Lincoln, Nebr. • Maydwell & Hartzell, Inc., San Francisco
Perry Sankie Co., San Antonio • San Antonio Machine & Supply Co., San Antonio
Southern Electric Equipment Co., Atlanta • Chas. L. Ward Co., Kansas City, Mo.
Westinghouse Electric Supply Co., New York City (and branches)
Williamson Sales Co., Shreveport, Dallas and Houston

See "Mr. Peepers" Sundays NBC-TV. Consult local listing for time and station.

REYNOLDS ALUMINUM

MODERN DESIGN HAS ALUMINUM IN MIND

Twist-Lock
TRADE-MARK

FIRST AND STILL THE FINEST

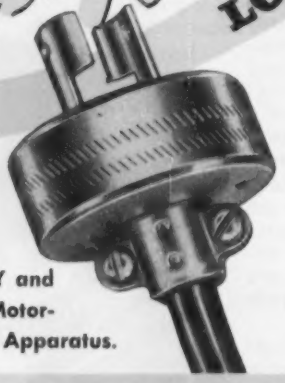
ELECTRICAL CONNECTORS

No. 7688
No. 7542

PLUG IN-- TWIST --LOCKED

Rugged

AND IT'S



For Greater CONVENIENCE, SAFETY and EFFICIENCY in the Operation of Motor-driven Tools or Portable Electrical Apparatus.

NEVER DISCONNECTS ACCIDENTALLY

The Hubbell Twist-Lock locking action insures a positive contact that will not come loose accidentally regardless of rough treatment, heavy vibration, or other conditions that might cause down-time and production loss. Twist-Lock is made in two-wire, three-wire and four-wire sizes. The three and four-wire sizes are available grounded and not grounded. For complete information, write Harvey Hubbell Inc., Dept. E-2, Bridgeport, Conn.

Here's the answer to many of your wiring problems. Write for this Twist-Lock booklet today!

THESE FEATURES MAKE ALL THE DIFFERENCE

- Properly polarized for protection against fire and shock.
- Three and four-wire types available grounded to metal cover on request.
- All exposed metal parts plated to resist corrosion.
- Precision-engineered for positive locking action.
- Sturdy cord grips eliminate wire "pull out."

Highest Grade HEAVY DUTY

WIRING HUBBELL DEVICES

HARVEY HUBBELL, INC.
BRIDGEPORT, CONN.

NH54

permanent lubrication, and rugged and light weight construction.

Commutated capacitor principle of operation provides freedom from damage due to overspeeding or selection of wrong range. A built-in calibration circuit provides a quick, positive check on performance. Tachometers and range extending adapters are available to measure speeds as low as 2 rpm and up to 100,000 rpm.
Metron Instrument Co, 432 Lincoln St, Denver 3, Colo.

Relay

An improved zone distance impedance relay, Type HZM, provides high-speed protection from phase faults occurring on single lines, closed loops, and parallel transmission lines. It also gives backup protection for adjoining line sections.

The auxiliary adjusting unit used to modify impedance characteristics of the relay, providing phase-angle discrimination between load and fault conditions, is contained within the case. Its inclusion facilitates testing of the relay. The relay is rated at 1 to 10-ohm range, 115-v, 60-cps operating winding, and 125 and 250-v dc trip circuits.
Westinghouse Electric Corp, P. O. Box 2099, Pittsburgh 30, Pa.

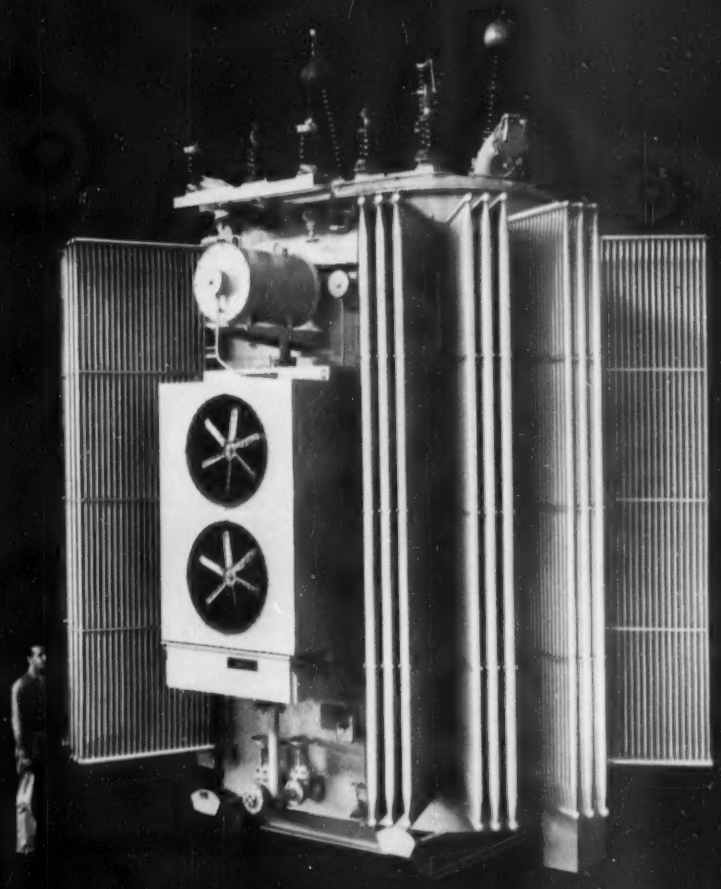
MORE NEW PRODUCTS
about which you should know

A. O. Smith Corp, Box 584, Milwaukee 1, Wis., announces a new line of **motors** available in frame sizes 182, 184, 203, and 204 . . . Toledo Pipe Threading Machine Co, 1445 Summit St, Toledo 4, Ohio, has a new **power drive** for efficient operation of hand pipe threaders, cutters, and reamers.

General Electric Co, 1285 Boston Ave, Bridgeport 2, Conn., announces a new motor-driven **master switch** having 25 switches and rated 3 amp, 25 v. In addition, GE has a new 30-v, indoor, **remote-control wire** . . . Sterling Engineering Co, Inc, Laconia, N. H., has a new split-phase **motor relay** that takes the place of the conventional centrifugal switch.

41,667 KVA SINGLE PHASE

PENNSYLVANIA POWER TRANSFORMER



Seven of these Pennsylvania power transformers are installed in two 125,000 Kva banks, with one unit serving as a spare. The transformers are designed to step down a transmission voltage of 110,000 volts. Each transformer has a capacity of 41,667 Kva when both forced-oil—forced-air heat exchangers are in operation. When only one of the heat exchangers is used, each transformer can be loaded to 33,333 Kva. Self-cooled, each transformer has a rating of 25,000 Kva.

Low Voltage windings are wound in two sections — each equal to one-half the rating of the High Voltage windings — and brought out through separate bushings.

See next page for inside story

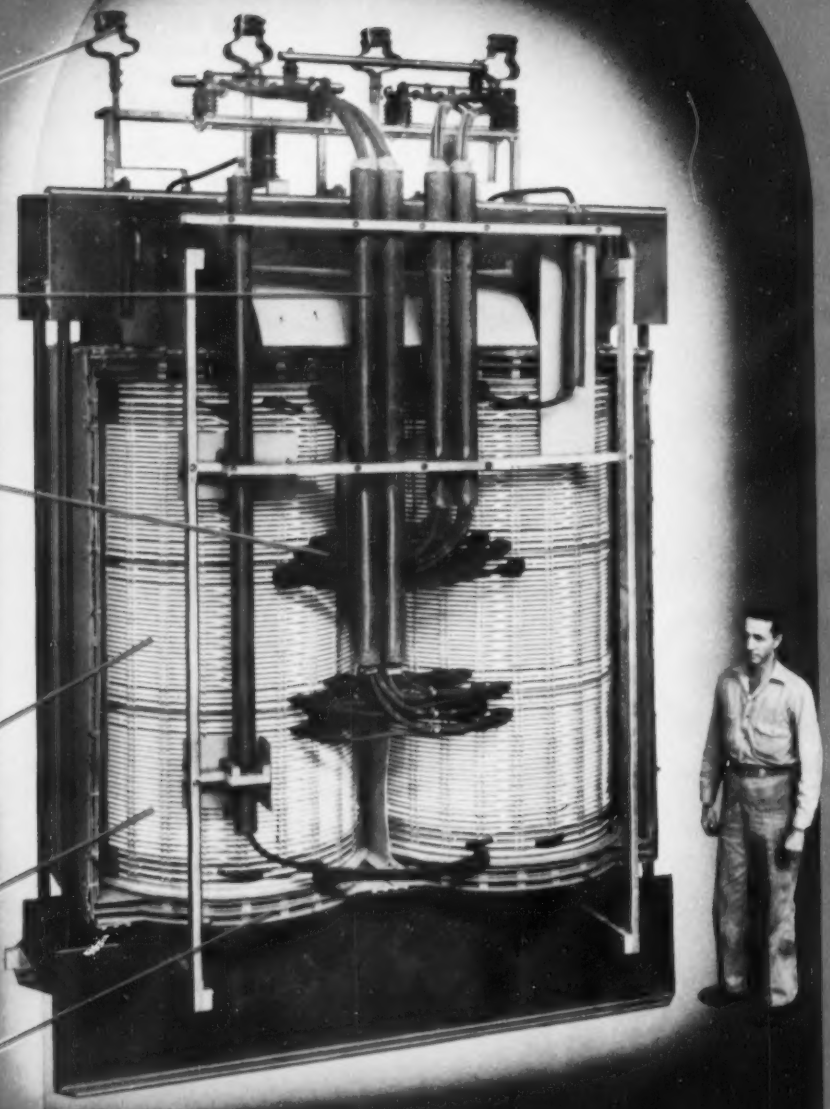
pt

PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division

CANONSBURG, PENNSYLVANIA • *Greater Pittsburgh District*

Inside a 41,667 KVA, single phase PENNSYLVANIA POWER TRANSFORMER



Flexible Low Voltage bushing connectors.

Well-insulated tap leads, rigidly supported, are connected to Pennsylvania straight line no-load tap changers.

Two sets of taps per coil assure excellent electrical and mechanical balance in the windings.

Coils are precompressed with force equal to the highest short circuit stress and built into the transformer at that compressed dimension. This prevents mechanical distortion of the coils if short circuit stresses occur.

Continuous pancake winding in High Voltage coils. Helical winding in Low Voltage coils.

Extra heavy insulation at line ends of coils. Graded insulation at ground ends of coils.

pt

For exterior view of this transformer, see other side.

25,000/33,333/41,667 Kva. Single Phase, 60 Cycles, 55 C. Temperature rise. High Voltage: 110,000 volts. Low voltage: 7,950/13,800 volts.

PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division

CANONSBURG, PA. *Greater Pittsburgh District*

LETTERS TO THE EDITOR

Not So Public Relations

To the Editor:

Your editorial, "With Every Speech, a Press Release," in the Nov. 30 issue on the need for the private utilities to tell their story at any and every public opportunity strikes me as the soundest advice handed out in a "coon's age."

It has long been my personal contention that the private utilities as a body are "gun-shy" to the point of being almost cowardly in their failure to tell their story in an adequate manner, to say nothing of the way it could and should be done.

Why, you would almost think it is a cardinal sin to stand up and admit that the private utility companies, individually and collectively, are in business to render a service at a fair rate of return to their stockholders. That this is being done in the face of constantly rising labor and fuel costs attests to the efficiency of all phases of utility management from engineering up the line to the president and down the line to the janitor.

The average electric company customer doesn't have any more idea than a pig about Sunday of the tremendous investment he puts to work at the flip of a switch. He doesn't give it a second thought until nature disrupts the system. Then he gets as mad as a wet old hen at the power company.

Last summer a utility company's territory was hit by a hurricane. This company did a tremendous job in its usual efficient way of restoring service promptly to the affected area. Its public relations department prepared a hard hitting, fact-laden story of this performance above and beyond the call of duty rendered by its people. Where do you think they published it? In the company house organ. The employees didn't have to read that story. They lived it. Sure they had some reprints made. Where do you think they distributed these? To large industrial customers who already knew the score.

For a few dollars these reprints could have been mailed to every customer on the system. Then maybe the little customer out in the area that the hurricane didn't hit might have found out why the company was so darned slow at that time in getting a man out to replace his fuse.

And some of the national magazines might have been glad to use the story. Perhaps Reader's Digest would have done a reprint. At least it would have been worth the try to tell a great industry's story.

Movies, films on TV, and luncheon speakers who are not afraid to defend their employers are all important in making the people who have never had a chance to understand utility economics understand the industry's story.

But once and for all the utilities must shuck the jail bird, hang-dog attitude that seems to imply that they are engaged in a business bordering on the criminal.

Ken Miller
Eastern Area Supervisor of Sales
Preformed Line Products Co
Cleveland, Ohio

Progress-Less Wiring

To the Editor:

The article and pictures on pages 76 and 77 of the Nov. 30 issue of Electrical World convey a perfect picture of "No Progress" for the past 50 years on the subject of "inadequate wiring."

It is common knowledge that water and gas are brought to the service entrance at higher pressures than are required and then the flow is controlled manually by reducing valves to deliver the amount needed.

Power and distribution engineers regulate voltages from the generator to the customer, so why not give the customers some regulation of voltage where it is needed the most?

I suggest that 3-wire, 240-v services be increased to 480 v, feeding a 2:1 ratio transformer, with built-in, automatic voltage regulation, located in or near the kitchen, or load center.

The design of such a unit should prove an interesting challenge to the engineering fraternity at large.

Bertram C. Rogers, Sr.
Sharon, Pa.

Glasses Are Steamed Up

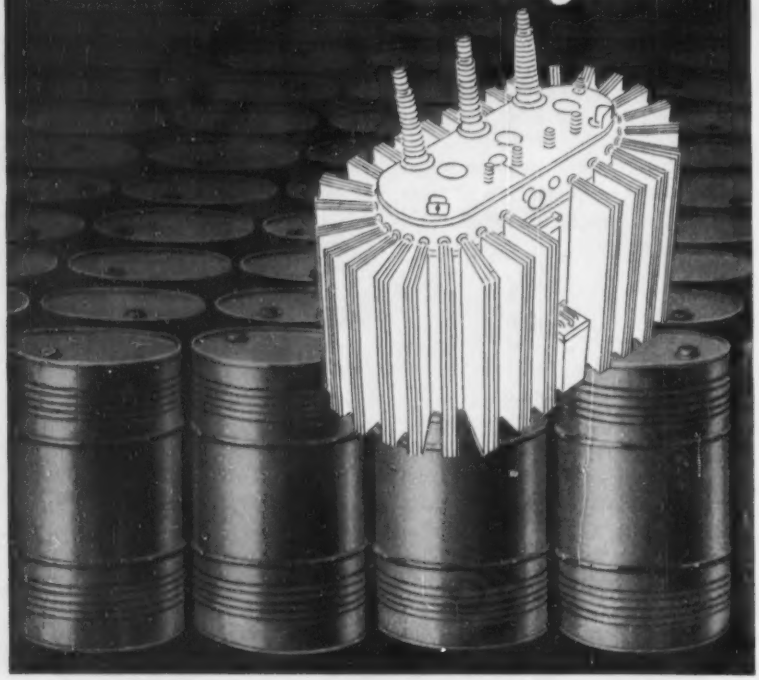
To the Editor:

Accept, please, my compliments on the excellent compendium of electric house heating material in your issue of Nov. 2. After studying this material, it occurred to me that there are certain aspects of the house heating load that have not yet been included adequately in utility consideration of it. They are:

- House heating is a component of residential load. It should be considered as such, not as a separate entity. This point is made in your editorial in the issue, but the articles from the several utilities do not indicate that it enters into their thinking. Demand, diversity, and load factor data of the heating load alone do not present a true picture of the requirements of electricity supply imposed by the load.
- The value of the unity power factor load of resistance heating is not recognized. This is important from the investment angle because much of the continuing increase in summer load—air conditioning, for instance—is of low power factor. This difference in power factor allows the same system facilities to carry a higher load of heating than they can of air conditioning.
- No weight appears to be given by utilities to the fact that system facilities can carry heavier loads in the lower temperatures of winter than in the higher temperatures of summer. This fact, plus the power factor difference noted, says that investment to serve summer air conditioning will earn a much higher return in winter, serving resistance heating.
- It has been demonstrated that the heating load can be reduced by 75% during the half-hour to two hours or so of the system peak without discomfort to users, without, in fact, their being aware of it. It is also true that the daily peak of the heating load naturally occurs in the valley of the system load. Thus heating can be regarded as largely an off-peak load. But utilities do not seem disposed so to regard it.
- Utilities seem to look on house heating as a problem. As exponents of enterprise, they should see it as an opportunity for growth of their business, for greater service to their customers. I advise them to take off the blue glasses and put on rose-colored ones when they take their next look at house heating.

William J. Canada
Engineering Consultant
Mountain Lakes, N. J.

Transformer oil, treated with DBPC lasts 14 times longer!



• Accelerated oxidation tests have proved that new transformer oil treated with 0.3% of DBPC inhibitor (di-tert-butyl-para-cresol) will last *14 times longer* than untreated oil. Since today's high-load transformers require a sludge-free insulating oil to operate efficiently, the extra-long life offered by this Koppers anti-oxidant is highly important from a technical as well as an economical standpoint. DBPC assures more dependable transformer performance by increasing the resistance of the oil to oxidation, thereby keeping sludge formation to a minimum.

Reclaimed oil will last longer, too, when treated with DBPC. Although badly deteriorated and heavily sludged, used oil can be restored by treatment with fuller's earth and DBPC so that it will actually outlast brand new uninhibited oil.

DBPC is available in an oil solution called "Impruvol 20." In either solution or solid form, this Koppers inhibitor is also used successfully in switch gear. Write today for additional information.

KOPPERS®

Koppers Chemicals

KOPPERS COMPANY, INC.

Chemical Division, Pittsburgh 19, Pennsylvania

WHAT THEY'RE SAYING

At Industry Meetings

New Products Will Prop Up Slackening Appliance Sales

D. A. PACKARD, general sales manager, Kelvinator Division, Nash-Kelvinator Corp, at Western distributors meeting

It is true that some individual products can be expected to decline this year, but new products are continually taking up the slack. Laundry eqnipment sales are moving toward new highs; room air conditioners face a vast, untapped market; kitchen cabinet sales have a tremendous potential; and freezers promise a new way of living and steady growth.

The year 1954 will be highly competitive, but there is plenty of business to be had by the sales organizafion that is willing to go out and fight for it, in a sensible manner, with emphasis on service to the consumer at prices that are truly competitive.

Success of Rural Electrification Requires Industry-Wide Cooperation

ANCHER NELSEN, Administrator, Rural Electrification Administration, at Management Conference for Power-Type Borrowers, Washington, D. C.

I believe that REA's G&T loan authority is absolutely vital to give the farmer the bargaining power he needs to get reasonably priced electricity. If there should be any attack on that authority, I want you to know that you can count on my determined effort to protect that right which has been so productive for farmers.

If we are to protect and keep this vital right, there is one aspect of the G&T situation which we think deserves more attention than it may have had in the past. This is the question of cost. The farmer simply must not be saddled with costs for electricity that he cannot and will not bear.

It seems to me that a better way must be found to put the excess capacity of some of our generating plants to work around the clock. We must find a way to sell our surplus power and we need to find suppliers to furnish us with power for our peak loads.

Many of our generation cooperatives have worked out system integrations that have produced savings for their farm consumers and that have provided greater possibilities for continuity of service. I am fully aware that the development along this line will require an atmosphere of cooperation and understanding between the REA borrowers and the other power suppliers. I am gratified that there appears evidence everywhere that such an atmosphere is developing.

On both sides, it will take patience and a willingness to forget the scars of the battles that occurred in some places in the past. That also means the private utilities, many of which have been obstinate and short-sighted in the past.

It will not come at once, but in the long run it seems to me we must have a high degree of cooperation among the various power suppliers in the interest of the nation, the farmers, and the power suppliers themselves.

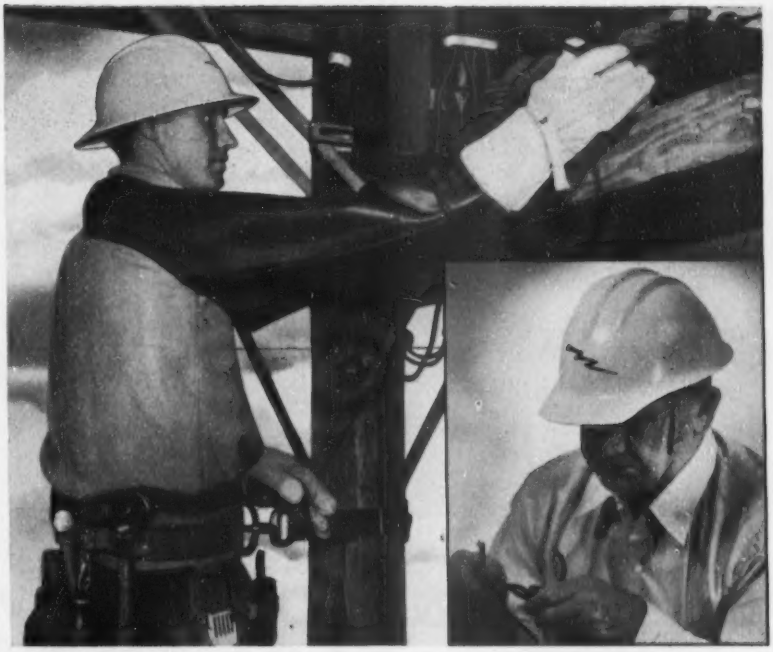
Full Employment Economy Requires More Electricity

LEON KEYSERLING, former chairman of the Council of Economic Advisers, at National Electric Consumers Conference, Denver, Colo.

Taking all factors into account, there is need for a more rapid rate of growth in the nation's supply of electric energy than ever before to correlate with a full employment economy. Even if the 1951 record rate of growth in generating capacity were to be maintained from now on forward, we would by 1975 be at least 20% short of the requirements for full employment in an expanding economy.

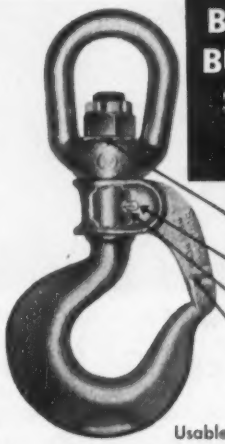
There is place in this picture for all types of developments. It is estimated that hydro facilities can be increased about 3½-fold by 1975; but even then this would be supplying only about one-quarter of total need —which would not be a larger proportion than in recent years.

The fact that the supply of electricity needs to grow more rapidly than the whole economy does not mean that there is not an intimate connection between the two. Unless power production grows sufficiently, the economy as a whole cannot grow sufficiently; and, conversely, unless the economy as a whole grows sufficiently, there will not be a sufficient demand for electric output.



TESTS PROVE* Bullard 10KV safety hats and caps give complete head protection both from head blows from falling wrenches, insulators, "rake-sticks" and from contact with "hot" lines. Every Bullard hat and cap is tested before it leaves the factory to 10,000 volts . . . and every hat and cap passes industrial and federal 40 ft. pound resistance tests. No holes or rivets that might eventually cause leakage pass through crown or brim. Permanent colors available at no added cost. Universal headsize.

ELECTRICAL INDUSTRIES SLASH ACCIDENT COSTS!



BULLARD BURNHAM SAFETY HOOKS

Anti-friction bearing
Locking pin
Locking groove
Non-corrosive brass safety gate

Usable with every type of equipment (chain hoists, horizontal tuggers, come-a-longs, cranes, block and tackle, and snatch blocks). The B-B safety hook provides complete PROTECTION where accidents begin.

Since 1898
E. D. BULLARD COMPANY
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Distributors in principal cities around the world

Electrical industries, nation-wide, are discovering accident liability costs and valuable man hours can be sharply reduced by equipping employees with Bullard safety equipment specially designed to combat electrical hazards.

WINTER LINERS
Protects head, neck and ears against extreme cold.

EVERYTHING BULLARD IN SAFETY
T.M.'S REG. U. S. PAT. OFF.
TESTED 10,000 VOLTS 10 Kv
HARD BOILED

***FREE**—write for Multiphase laboratory report and circular on 10KV hats and caps. Brochure also available on Bullard-Burnham hooks.

H. G. DILLIN

RALPH J. PHILLIPS

San Diego G&E's Changes . . .

. . . make Dillin executive vice president and Phillips a VP of sales. President Sherwin becomes chief executive officer

With the retirement of L. M. Klauber as chairman of the board and chief executive officer, San Diego Gas & Electric Co has announced a major realignment of top management. At the same time the utility announced that the board of directors has amended its by-laws to abolish the position of chairman of the board.

Here is the new line-up of the top officials of the company.

Pres E. D. Sherwin takes on the added title of chief executive officer of the utility.

H. G. Dillin, formerly vice president in charge of sales, becomes executive vice president, a newly created position. Dillin's successor is Ralph J. Phillips, formerly manager of sales.

Continues As Board Member . . . Klauber remains as a member of the board of directors and will continue to sit in top management councils as a member of the new executive committee, together with Sherwin and Dillin.

Dillin replaces Hance H. Cleland as a member of the board of directors. Absence of the title of chairman of the board is nothing new to San Diego G&E. The position was created in 1946 when Cleland relinquished the presidency to Klauber and became chairman. In 1949 Klauber succeeded Cleland as chairman when Sherwin was named president.

Started As Draftsman . . . The new executive vice president joined the company in 1924 as a draftsman in the engineering department after attending San Diego State College and the University of California. He has served in the new business department as engineer in charge of rates, rules and regulations, and as commercial manager. He became vice president in charge of sales in 1949.

Phillips, a graduate of Rensselaer Polytechnic Institute, started with the utility as a gas salesman in 1926. Later he became engineer in charge of gas sales and in 1952 was made manager of sales.

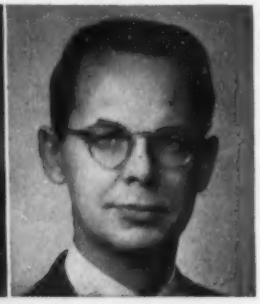
•

Harold H. Scaff, vice president of Ebasco Services, Inc, New York, has been named chairman of the budget and finance committee of the Controllers Institute of America. In other institute appointments, **Joseph U. Diehl,** vice president of Pennsylvania Water & Power Co, was made vice chairman of the securities and exchange regulation committee. **Ralph H. Smith,** comptroller of Cleveland Electric Illuminating Co, was named vice chairman of the education committee.

C. A. Fike, superintendent of manufacturing at the Cleveland plant of Westinghouse Electric Corp's Lighting Division, has been appointed manager of manufacturing at that plant.

GRAHAM CLAYTOR

H. A. KAMMER



DONALD C. COOK

American G&E Service Executive VP's

Election of three executive vice presidents has been announced by American Gas & Electric Service Corp.

The following former vice presidents were named to the newly created positions: Graham Claytor, executive vice president, operating and commercial; H. A. Kammer, executive vice president, engineering, construction, and purchasing; and Donald C. Cook, executive vice president, legal, finance, and accounting. Cook, who joined the service corporation last summer (EW, July 20, p 33), formerly was chairman of the Securities and Exchange Commission. Claytor also is a vice president of American Gas & Electric Co operating subsidiary companies. Kammer is a vice president of Ohio Valley Electric Corp and its subsidiary, Indiana-Kentucky Electric Corp.

Coming Up!

Steel for Electric Utilities

You can always be sure of fast action when you call Ryerson for steel. Sure that your requirements will get prompt, interested attention.

At each of 15 strategically located Ryerson plants experienced steel men who know the special needs of your industry are ready to work with you. And at Ryerson you draw on the most widely diversified stocks. Carbon steel, alloys, stainless—though it's still difficult to keep every size of every product always on hand, you will find we can take care of most every steel requirement.

You can have your steel cut to size, too, and you can always depend on Ryerson quality. So for every steel requirement, call your nearby Ryerson plant.

PRINCIPAL PRODUCTS

CARBON STEEL BARS — Hot rolled and cold finished

STRUCTURALS — Channels, angles, beams, etc.

PLATES — Many types including Inland 4-Way Safety Plate

SHEETS — Hot and cold rolled, many types and coatings

TUBING — Seamless and welded, mechanical and boiler tubes

ALLOYS — Hot rolled, cold finished, heat treated. Also tool steel

STAINLESS — Stainless bars, plates, sheets, tubes, etc.

BABBITT—Five types, also Ryertex plastic bearings.

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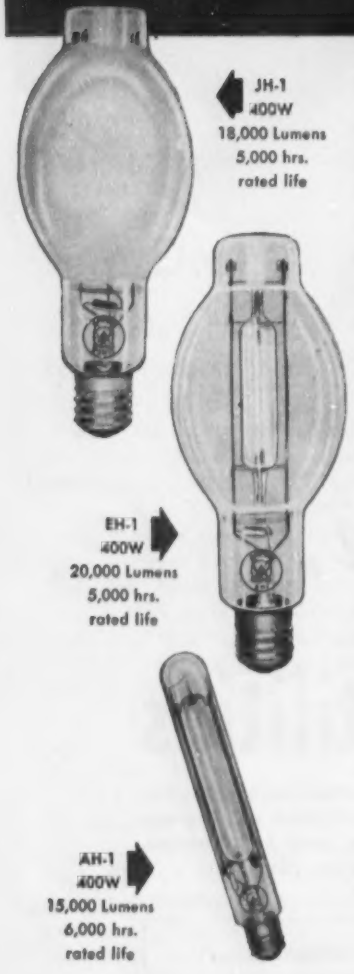
STREET LIGHTING GOES MODERN!

WITH AMPLEX MERCURY VAPOR LAMPS



TWICE AS MUCH LIGHT for the same wattage consumed... double the illumination with no boost in the lighting bill. Burning life several times longer than incandescents. That's what municipalities and utilities get with the new Amplex Mercury Vapor Lamps for street lighting... and it adds up to completely new lighting efficiency and extraordinary economies.

Amplex Mercury Vapor Lamps are made in three types, the ever-popular EH-1 and AH-1, and the highly important new JH-1 which is color-corrected by means of a special phosphor coating that produces a warm, neutral light and abolishes all need for color-correcting incandescents. Performance facts of all three lamps are shown under their respective illustrations.

For the full story on Amplex Mercury Vapor Lamps and for detailed information regarding their practical application, write **Amplex Corporation, Department J-1, 111 Water Street, Brooklyn 1, New York.**

AMPLEX

Incandescent, Fluorescent, Sealed-Beam Reflector, Infra-Red, Rough Service, Mercury Vapor, Photoflash, Street Lighting and Traffic Signal Lamps, Swivelites, Hi-Hats and Display Lighting Accessories.

WILLIAM B. TIPPY

Tippy Made Executive VP of Commonwealth Services

William B. Tippy, vice president of Commonwealth Services, Inc, has been appointed executive vice president of the New York utility and industrial consulting firm.

Tippy, who has been active in public utility operations since 1932, has been a vice president of Commonwealth Services since 1947. Prior to this he held executive positions with Consumers Power Co in various Michigan divisions, starting in 1936.

He was graduated from Williams College in 1930 and received his electrical engineering degree from the University of Michigan two years later. Following completion of his education, he became associated with Detroit Edison Co and General Electric Co.

•

George G. Zipf has been appointed superintendent of the steel plant of the Tubular Products Division of Babcock & Wilcox Co at Beaver Falls, Pa. Prior to his promotion, Zipf was assistant superintendent of the steel plant in charge of melting and blooming. He joined Babcock & Wilcox in 1942.

Gilbert J. Williams, Central Division manager for Connecticut Light & Power Co, has been appointed manager of the utility's Western Division with headquarters at Waterbury. He succeeds **W. T. Jebb,** who resigned to become vice president and general manager of the Hartford (Conn.) Gas

Co. **Hugh T. Corcoran,** Connecticut L&P's district manager at New Britain since 1945, replaces Williams as Central Division manager. **James H. Doak,** assistant to the vice president in charge of employee and public relations, was made Meriden district manager.

Althouse Is Promoted by Central Hudson G&E

Ernest E. Althouse has been named general operating manager of Central Hudson Gas & Electric Corp, Poughkeepsie, N. Y., to fill the vacancy created by the death of John O. Fuchs (EW, Dec. 7, p 30). Prior to this new appointment, Althouse held the positions of electric operating manager and assistant general operating manager.

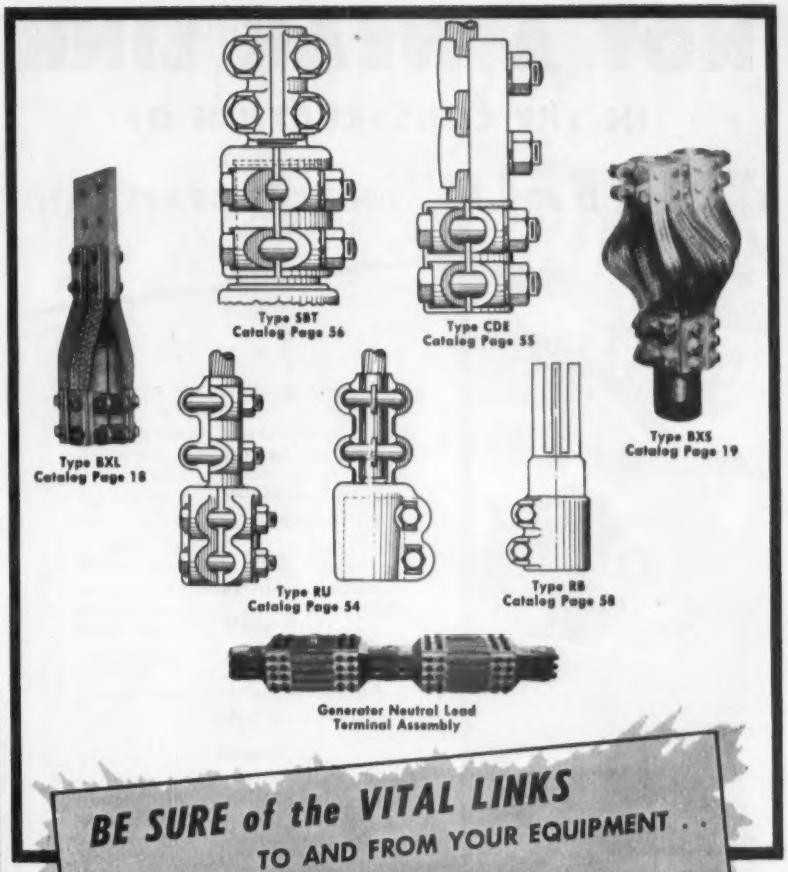
Althouse joined Central Hudson G&E in 1928 as assistant engineer in

ERNEST E. ALTHOUSE

the general operating, engineering department. Later he served as design engineer, Kingston operation superintendent and division superintendent. In 1938 he transferred back to Poughkeepsie and served as assistant electric distribution manager and later distribution manager.

He was appointed administrative assistant to the vice president in charge of operations in 1951 and electric operating manager a year later.

William H. Draper, Jr, has been elected a director of Mexican Light & Power Co, Ltd. On April 1 Draper, a former U. S. special representative in Europe with the rank of ambassa-



BE SURE of the VITAL LINKS
TO AND FROM YOUR EQUIPMENT . .

Specify Royal STUD CONNECTORS and EQUIPMENT TERMINALS

• Royal Power Connectors have been produced in a wide variety of types and sizes for many years. They are manufactured from high-conductivity, high strength copper alloy. Multiplicity of point contacts develop the lowest resistance and highest pull-out strength. ½-inch Silicon Bronze hex head bolts are standard for conductor sizes from ½" IPS and larger, and 500 MCM and larger. Nested bolt heads permit "one wrench" installation. Write for a copy of our new catalog No. 12. You'll find it interesting, useful and informative.

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Designers and Manufacturers of Power Switching Equipment and Special Electrical Devices

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"BUFFALO" INDUCED DRAFT FANS

So much depends on the continued operation of your draft fans that it pays to be sure that there are no weak links in the construction. Housings, wheels, blades, bearings and shafts—*all* must be up to the job, or the fan as a whole cannot function.

Every part of a "Buffalo" Induced Draft Fan is built up to stand known conditions of wear, heat and erosion. The shaft is turned from a solid piece of forged steel with extra large thrust collars. Bearings are heavy-duty, self-aligning and water-cooled. Housings are heavy-gauge steel, hot-riveted, with removable scroll liners where erosion is most severe. Blades are built up with welded-on wearing strips. In short, every "link" in the construction of these fans is designed for maximum long life in this punishing fan job.

It is all part of the "Q" Factor* which assures you of best results whenever you buy "Buffalo". Write now for Engineering Bulletin 3750.

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Publishers of "Fan Engineering" Handbook
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

"Buffalo" DRAFT FANS

** The "Q" Factor— The built-in quality which provides trouble-free satisfaction and long life.*

dor, will replace **George S. Messersmith** as chairman and chief executive officer of the utility. Messersmith, who has been the company's chief executive for six years, will continue on the board as honorary chairman.

John Goodwin Reese has been advanced from assistant comptroller to comptroller of Houston Lighting & Power Co. **William R. Brown,** attorney with the utility's legal counsel, Baker, Botts, Andrews, and Parish, has been elected a director of the company. In other Houston L&P appointments, **Pres W. A. Parish** was elected a member of the finance committee. **T. H. Wharton,** financial executive vice president, and **Robert W. Henderson,** a director of the utility's board of directors, were named members of the board's executive committee.

Howard W. Lovett has been appointed industrial and switchgear sales manager by Roller-Smith Corp, Bethlehem, Pa. He has been in the sales and engineering departments of Roller-Smith for 15 years.

WILLIAM E. WILTON

Elected a Vice President

William E. Wilton, works manager of Jasper Blackburn Corp, St. Louis, has been appointed vice president in charge of engineering for the firm. After graduating from Illinois College in 1939, Wilton joined Jasper Blackburn. He served in several departments before becoming works manager in 1951.

System Stability

(*Continued from page* 99)

fault-cleared conditions is also headed upward. This means that the power-angle curve for the fault-cleared condition is relatively low. The more this curve is lowered, the more the problem of restoring the system after a fault is increased.

One of the reasons for the trend to higher ΔX is the constant effort to reduce costs. As high-voltage circuit breaker positions may cost from $100,000 to $300,000, reducing the number required by a particular system layout is an important method of lowering costs. The skip-stop design, Fig 3, is effective in this connection, but it does increase ΔX in comparison with the designs where all lines of the backbone transmission are connected to every bus.

The split-bus design, Fig 2, and the duplex reactor, Fig 4, also increase ΔX. For example, Fig 2a illustrates a case where the alternative path for power is directly over line 2 when line 1 between A and B is tripped out. In Fig 2b the alternative path includes a double transformation at the generating station and at the receiving station.

The relative magnitude of ΔX is conveniently expressed by computing the normal and fault-cleared system reactances in per unit on a kva base equal to maximum turbine capability. A pair of generators with a normal/emergency reactance of 0.25/0.63 on this basis is being operated successfully although the ΔX is rather high.

Techniques for analyzing stability problems are widely understood, and there are available solutions for all problems of this type at a price that depends on particular situations.

References . . . For the reader who desires additional information on the subject, the following articles are recommended: 1. Kilover Supply Should Be Planned, C. H. Hoffman, Electrical World, August 25, 1952, pp 92-5. 2. Low Short-Circuit Ratio is Practical For Today's Turbine Generators, S. B. Crary and J. B. McClure, Electrical World, June 30, 1952, pp 65-9. 3. System Stability Limitations and Generator Loading, H. C. Anderson, H. O. Simmons, Jr., and C. A. Woodrow, AIEE Power Apparatus and Systems, August, 1953, pp 406-23.

SANTA FE RAILWAY · UNION PACIFIC RAILROAD · SOUTHERN PACIFIC COMPANY

Specifications for the stringent power requirements for Los Angeles Union Passenger Terminal were set up by a group of electrical engineers representing the three railroads that operate the terminal, and were met by the purchase of Marcus dry type Transformers.

The installation consisted of 12 Marcus 300 KVA, 3 Marcus 225 KVA dry type Transformers installed outdoors. All Marcus dry type Transformers are now being constructed with Hi-Heat, Hi-Dielectric Magnet Wire, insulated with DuPont's Newest miracle polyester film "Mylar," combined with Johns-Manville "Quinterra" to reach insulation levels at least 10 times present industry standards.

Increase your power performance standards with Marcus dry type Transformers.

Capacities from 1 to 3000 KVA

- DISTRIBUTION
- GENERAL PURPOSE
- UNIT SUBSTATION
- PHASE CHANGING
- ELECTRIC FURNACE
- RECTIFIER
- WELDING
- MOTOR STARTING
- SPECIAL

"Mark of Quality"

Representatives in Principal Cities

MARCUS TRANSFORMER CO., INC.
HILLSIDE 5, NEW JERSEY

ONE OF THE WORLD'S LARGEST MANUFACTURERS OF DRY TYPE TRANSFORMERS EXCLUSIVELY

Sylvania's Sales . . .

. . . for 1953 are expected to total about $295 million, highest in firm's 52-year history

Sylvania Electric Products, Inc, has reported that net sales for 1953 were the highest in its 52-year history, representing a 25% gain over 1952 sales.

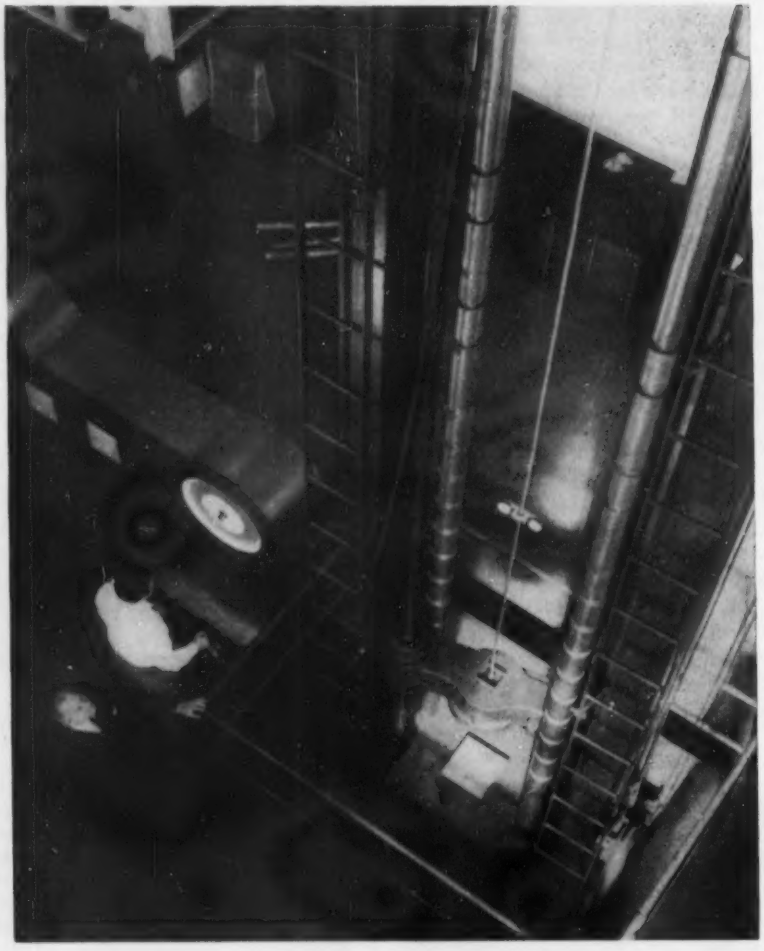
Pres H. Ward Zimmer, in a year-end statement, termed the year "a highly successful one for Sylvania." He said net sales for 1953 are expected to total about $295 million compared with a previous all-time high of $235 million in 1952 and $203 million in 1951.

Sales in 1953 of the products of each of Sylvania's seven operating divisions exceeded corresponding sales for 1952, Pres Zimmer said. The operating divisions are radio tube, radio and television, lighting, television picture tube, electronics, parts, and tungsten and chemical.

Trend to Buyers' Market . . . Pres Zimmer commented that although the entire national economy will be at an extremely high level in 1954, there will be a decided trend toward a more normal, and far healthier, buyers' market. He said, "Our plant and equipment expansion has put us in the strongest position in our history. This fact, together with increased sales and promotional efforts, will enable us to meet forcefully the highly competitive conditions which will exist throughout most markets."

Sylvania's defense business during 1953 amounted to approximately 22% of total sales compared with 30% in 1952, according to the Sylvania executive.

Pres Zimmer called attention to Sylvania's development of fuel elements for atomic power plants. Although details on the work of Sylvania's Atomic Energy Division cannot be divulged for security reasons, Pres Zimmer said "It may be reported that significant progress was made during 1953 in the direction of developmental work, aimed at ultimate commercial production of reactor fuels and nuclear components, which constitute the heart of the atomic process."



3-Story Unit Tests Aluminum Cable

This three-story high tensile testing machine is shown putting the aluminum cable through its paces at the Hastings (N. Y.) Laboratories of Anaconda Wire & Cable Co. Here section of ACSR (336,400 cir. mil) gets stretched to the breaking point in machine which can exert up to 200,000 lb pull. Anaconda's Research Director Harry Thompson is standing alongside electric eye mechanism, at knee-level, which protects technicians on floor when platform is raised by freezing it in position. Current will not go on again until switch is thrown.

Tensile tester is a multi-purpose instrument which records stress-strain on cable, strain-time elapsed, and multi-point temperatures. It is equipped with a constant load maintainer, and a loading rate indicator.

GE Develops Device to Inspect Mica Tape

Development of new automatic inspection device to speed output and insure uniform quality of mica sheet electrical insulating materials has been revealed by General Electric Co.

The device was designed and built by GE's General Engineering Laboratory, Schenectady, N. Y., to find, measure, and mark voids in such materials faster and more accurately than the best-trained inspector. In a year's test, it enabled a 260% boost in production of mica tape, which is used as

insulation in motors and generators.

If the quality of mica tape, as it passes through the inspection device, falls below an established level, the device sounds a signal and corrections are made. A permanent record of quality is obtained by means of a photoelectric recorder.

1953 Aluminum Output Reaches All-Time High

Primary aluminum production for 1953 is estimated at 2.5 billion lb, or about 33% over the 1,874,664,367 lb produced in 1952, according to the year-end statement issued by the Aluminum Association. The 1953 estimate is based on statistics for the first ten months, during which new monthly and quarterly records were set.

The Association stated that 1953 production would have been still higher had it not been for a power shortage in the South which resulted in some production loss in that area in the last quarter.

The industry's expansion program moved ahead on schedule during the year so that by year-end annual primary capacity was approximately 2,840,000,000 lb, including about 158 million lb of stand-by capacity using high-cost power. However, the third round of expansion, which was announced late in 1952 and which would have brought three new producers into the industry, has not materialized. This additional capacity is still being considered by the federal government and may be carried forward during 1954.

The Association has reported that a big increase in the use of aluminum street-lighting standards was noted in 1953.

MANUFACTURING BRIEFS

Kennecott Copper Corp's plans to enter the aluminum field materialized when Kaiser Aluminum & Chemical Corp announced recently that it would sell $16,250,000 par value of a new series of convertible preferred stock to Kennecott "for investment." The shares carry a 5½% dividend and will be convertible into common stock for 20 years at $30 a share. If

WINSLOW INSTRUMENTS... *for fast, reliable location and prevention of line faults and insulation failures*

Today, more and more linemen and maintenance engineers rely on Winslow instruments for speedy, positive location of line faults . . . and for PROTECTIVE MAINTENANCE that detects deteriorating insulation before it fails.

These rugged, accurate test sets are tried and proved in field and repair shop use . . . have an outstanding record in helping to shorten or eliminate costly breakdowns and service interruptions for communications, transportation and power companies.

Meg Ω Meter FOR INSULATION RESISTANCE TESTS

- Full test potential is assured because of the use of a true-ohmmeter (cross-coil ratiometer) indicator. This is impossible with any other type of indicator.
- The only type of ohmmeter that applies full potential for all tests because of cross-coil ratiometer.
- Rugged casing and components meet severe field use.
- Self contained hand-crank operated generator supplies full test voltage at all times . . . no batteries or other external power sources are needed.
- Direct reading . . . no ratios to set . . . no switches to turn
- Invaluable for checking of electrical rotating equipment, transformers and all wiring.
- Meets all U. S. Military specifications.

IMPROVED WHEATSTONE BRIDGE TEST SETS

- Accuracy maintained within 0.1% under extreme service conditions.
- Faster operation with single dial ratio selector.
- Arranged for self contained or external battery.
- Positive-contact, self-wiping switches—laminated blades.
- Three sensitivity ranges protect galvanometer.
- Rugged, light weight and compact for convenient field use.
- Oak or waterproof aluminum case, removable cover.
- Wheatstone Bridge, Murray, Varley, Hilborn, Fisher Loops.

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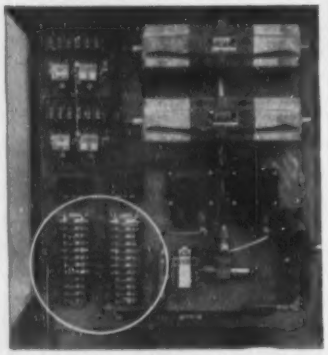
Another Use For

STATES
Type NT
TERMINAL BLOCKS



The switch mechanism shown above is that of The Royal Electric Manufacturing Company of Chicago and uses the States type NT Terminal Blocks.

Many electrical equipment manufacturers are turning to the States Terminal Block because of its unique sliding link.

An NT Installation in Generating Station.

States type NT sliding link Terminal Blocks make coding and testing of crowded circuits a simple matter. It is never necessary to remove for test any of the permanent wiring.

Built in any number of poles desired, front or back connected, with or without coding strip, with or without cover.

THE STATES COMPANY

THE STATES COMPANY
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Firm .....
City ..... Zone .... State.....

the shares were converted. Kennecott would acquire about 541,666 shares of common. The Kennecott investment will add up to only a small share of ownership of Kaiser Aluminum, which has more than 3.7 million common shares of stock outstanding.

Number of women employed in the electrical equipment industry in California has increased from 6,100 in 1949 to 25,000 in December, 1953, according to a report prepared for California's Gov Goodwin J. Knight by the state Division of Labor Statistics and Research.

SALES ASSIGNMENT

COMPANY STAFFS

Electric Storage Battery Co, Philadelphia, has appointed John W. Kelly manager of its Boston branch office. Kelly, who joined Electric Storage in 1946, formerly was a sales engineer with the company's Altanta (Ga.) branch.

Elliot Co, Jeannette, Pa., has appointed Raymond V. Thayer Cincinnati (Ohio) district manager. He joined Elliott in 1945 as a field engineer in the Cincinnati office, serving in that capacity until his present appointment.

MEETINGS CALENDAR

National Rural Electric Cooperative Association
Annual Meeting of Members, Dinner Key Auditorium, Miami, Fla., Jan. 11-14.

Doble Client Conference
Sponsored by Doble Engineering Co., Sheraton Plaza Hotel, Boston, Jan. 11-15.

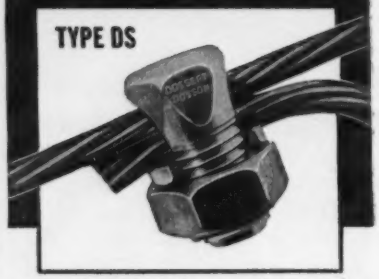
Public Information Program
Mid-Atlantic Region Meeting, Atlantic City, N. J., Jan. 15; West North Central Region Meeting, Madison, Wis., Feb. 5.

Edison Electric Institute
Accident Prevention Committee, Hotel Statler, Boston, Jan. 18-19; Industrial Relations Committee, Joint Meeting with Personnel Administration Section, Southeastern Electric Exchange and Southwestern Personnel Group, Hotel Roosevelt, New Orleans, La., Jan. 21-22; EEI-AGA Taxation Accounting Committee, Arlington Hotel, Hot Springs, Ark., Jan. 27-29; Joint Meeting of EEI Meter-Service Committee and Association of Edison Illuminating Companies Metering and Service Methods Committee, Adolphus Hotel, Dallas, Tex., Feb. 3-5; Transmission and Distribution Committee, Hotel Cleveland, Cleveland, Ohio, Feb. 9-10; Electrical Equipment Committee, Sheraton Cadillac Hotel, Detroit, Mich., Feb. 15-16; Industrial Relations Committee; EEI Headquarters, New York, March 18; Sales Meeting, Edgewater Beach Hotel, Chicago, April 5-8; EEI-AGA Accounting Conference, Hotel Statler, Boston, April 12-14; Industrial Relations Committee, Netherlands Plaza Hotel, Cincinnati, Ohio, April 15; Annual Meeting, Atlantic City, N. J., June 1-4.

American Institute of Electrical Engineers
Winter General Meeting, Statler Hotel, New York, Jan. 18-22; Conference on

DOSSON
SERVICE
CONNECTOR

TYPE DS



Proven by actual test and years of operation under all climatic conditions to permanently connect two wires with greater security and tightness. For quick, efficient connections of solid and stranded conductors in sizes No. 14 to 1000 MCM. High contact pressure between conductors assures trouble-free performance.

1. High translation of torque by low coefficient of friction
2. High contact pressure
3. Free from vibrational loosening
4. Withstands high tightening torque
5. Maximum contact area
6. Made of high strength "DURONZE" alloy
7. Better conductivity
8. High corrosion resistance
9. Economical—can be used over and over again
10. Dossert precision-manufactured

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Lakewood, Colorado
Little Rock, Arkansas
Minneapolis, Minnesota
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SINCE 1904

Feedback Control, Claridge Hotel, Atlantic City, N. J., April 22-23; Northeastern District Meeting, Schenectady, N. Y., May 5-7; Conference on Telemetering, Morrison Hotel Chicago, May 24-26; Summer General and Pacific General Meeting, Hotel Biltmore, Los Angeles, June 21-25.

Electrical Equipment Representatives Association
Winter 1954 Meeting, Biltmore Hotel, Los Angeles, Feb. 8-11.

Pennsylvania Electric Association
Winter Meeting, Transmission-Distribution Committee, Lord Baltimore Hotel, Baltimore, Feb. 11-12; Winter Meeting, Electrical Equipment Committee, Hotel Roosevelt, Pittsburgh, Feb. 25-26; Winter Meeting, Relay Committee, Benjamin Franklin Hotel, Philadelphia, March 4-5.

Public Utilities Advertising Association
Region 5 Meeting, Atlanta, Ga., Feb. 11-12; Region 1 Meeting, Montreal, Mount Royal Hotel, Que., Feb. 25-26; National Convention, Hotel Statler, Boston, May 13-14.

National Association of Purchasing Agents
Mid-Winter Conference, Public Utility Buyers' Group, Lord Baltimore Hotel, Baltimore, Md., Feb. 15-16.

National Adequate Wiring Bureau
10th Annual National Adequate Wiring Conference, La Salle Hotel, Chicago, Feb. 25-26.

Southern Safety Conference-Exposition
Kentucky Hotel, Louisville, Ky., March 7-9.

National Electrical Manufacturers Association
Spring Meeting, Edgewater Beach Hotel, Chicago, March 8-11.

Southeastern Electric Exchange
21st Annual Meeting, Boca Raton Hotel, Boca Raton, Fla., March 22-24; Spring Meeting, Engineering and Operation Section, Sans Souci Hotel, Miami Beach, Fla., May 6-7.

American Power Conference
Sherman Hotel, Chicago, March 24-26.

Northwest Public Power Association
Annual Convention, Winthrop Hotel, Tacoma, Wash., March 31-April 1-2.

Pacific Coast Electrical Association
Administration Services Section, Hotel Claremont, Berkeley, Calif., April 7-8; Annual Convention, Hotel Del Coronado, Coronado, Calif., May 19-21.

Illuminating Engineering Society
Southern Regional Conference, Roosevelt Hotel, New Orleans, La., April 8-9; Southwestern Regional Conference, Rice Hotel, Houston, Tex., April 11-14; Inter-Mountain Regional Conference, Denver, Colo., April 15-16; South Pacific Coast Regional Meeting, Museum of Art, San Francisco, April 19-20; Canadian Regional Meeting, King Edward Hotel, Toronto, Ont., April 28-30; Great Lakes Regional Meeting, Sheraton Cadillac Hotel, Detroit, May 3-4; Midwestern Regional Meeting, Hotel Jefferson, St. Louis, June 17-19.

A. & M. College of Texas
7th Annual Conference for Protective Relay Engineers, Department of Electrical Engineering, College Station, Tex., April 26-28.

American Welding Society
National Spring Technical Meeting, Hotel Statler, Buffalo, N. Y., May 4-7.

CIGRE
International Conferences on Large Electric High-Tension Systems, Paris, France, May 12-22.

Electrical Women's Round Table
1st Annual National Conference, Sheraton Hotel, St. Louis, May 14-15.

National Association of Electrical Distributors
Annual Convention, Atlantic City, N. J., June 6-11.

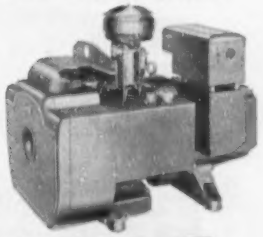
American Society of Mechanical Engineers
Semi-Annual Meeting, William Penn Hotel, Pittsburgh, June 20-24.

Michigan Electrical Association
Annual Convention, Grand Hotel, Mackinac Island, Mich., June 27-30.

*Addition this week.

The STANDOUT ELECTRIC PLANT for STANDBY ELECTRIC POWER

the New **ONAN "CW"**
(5,000 & 10,000 WATTS)



QUIET RUNNING

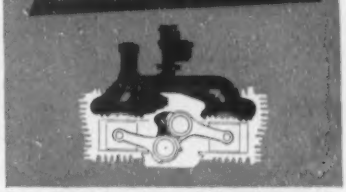
10CW—*10,000 watts A. C.*
High standby capacity for hospitals, hatcheries, schools, stores, plants.

5CW—*5,000 watts A. C.*
For homes, farms, police radio, micro-wave relay stations, etc.

COMPACT

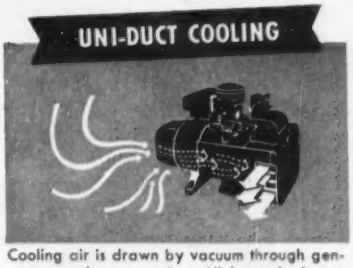
Takes less than one cubic yard of space. 10KW model requires only half the space of ordinary 10,000-watt plants. Easier to install. Connection box provided for quick hook up.

BUILT FOR HEAVY DUTY



Smooth running twin-cylinder, horizontally-opposed, 4-cycle air-cooled engines deliver rated horsepower at moderate speed. Unusually large bearing surfaces for long life

UNI-DUCT COOLING



Cooling air is drawn by vacuum through generator and over engine. All heated air expelled through one small vent which also discharges engine exhaust. Quiet operating.

DE LUXE EQUIPMENT

Nothing extra to buy. Impulse-coupled, high-tension magneto, radio shielded. Oil-bath air cleaner, fuel filter, oil pressure gauge, fuel tank, muffler and exhaust tubing.

COSTS LESS THAN ANY OTHER COMPLETE ELECTRIC PLANT!
The Onan "CW" combines exclusive design advantages with all the time-proved Onan features such as UNIT-BUILT CONSTRUCTION, *yet it costs less.* Get the complete story of this sensational, all-new electric plant.

Write for detailed specifications!

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Onan ELECTRIC PLANTS

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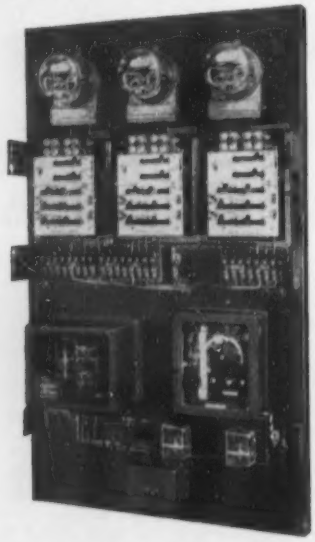
Transformer Loss Compensator

Saves you Money!

SPECIAL FEATURE: It saves you money because it provides an accurate means of measuring the energy and demands of high-voltage services at the low-voltage side of the transformer.



THE TESCO compensator adds to the registration of the watthour meter an amount equal to the sum of the iron and copper losses of the transformer bank. It may be used with practically any type of watthour meter and . . . importantly . . . no changes are made in the meter itself, either structurally or in adjustments . . . It is produced with two and three element types for use with two-element or three-element meters on any type circuit.

Some of the Users . . .

Phila. Electric Co. Penna. Power & Light Co. Texas Power & Light Co. U. S. Bureau of Recl. Public Service Co. of New Hampshire. Utah Power & Light Co. Northern States Power Co.

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EASTERN SPECIALTY CO.

PHILADELPHIA 40, PA.

Seattle City Light

(*Continued from page* 106)

in service, is intended primarily for operation during peaking periods, unless Ross Dam should be heightened to provide additional storage.

FPC Permit . . .

. . . requested by Puget Sound P&L to develop Columbia River site. Second plant coming later

While busily denouncing a "stockholders committee" (EW, 1/4, p 64) which wants the company to merge with Washington Water Power Co, Pres Frank McLaughlin of Puget Sound Power & Light Co filed application with the Federal Power Commission for a preliminary permit to develop one power site and announced he shortly would file for a second site.

Columbia River Permit . . . The preliminary permit sought by Puget Power would enable the company to carry out engineering and economic studies for a run-of-the-river dam on the Columbia River at Wells, about 60 miles north of the company's Rock Island Dam. The Army Corps of Engineers, in its "308" report, estimated a dam at this site would have an initial capacity of 400,000 kw and an ultimate capacity of 600,000 kw, at a cost of $193 million.

The proposed Wells dam would back the Columbia River substantially to the base of Chief Joseph Dam, now under construction about 30 miles upstream. A dam proposed by the Chelan County PUD downstream at Rocky Reach, between Wells and Rock Island, would back water approximately to the Wells site.

Puget's announcement of its plans for the Wells dam appears to eliminate the company from cooperation with other power companies of the area in joint construction of dams. McLaughlin stressed that construction of a dam at Wells, near existing transmission lines, would result in a minimum of transmission lines costs to bring the power across the mountains to the Puget Sound region—a distance of only about 125 miles. As most of the remaining sites for large-scale hydroelectric development are in Idaho and Montana, the matter of transmis-

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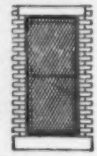
CHAIN LINK WIRE FENCE—All Beam Framework—the heaviest and strongest made

WIRE MESH PARTITIONS



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Stewart IRON and WIRE **FENCES**

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sion costs becomes an increasingly important factor as to power for utilization in western Washington, said McLaughlin.

Puget Power soon will apply to the FPC for a preliminary permit to further develop the Baker River in northwest Washington, McLaughlin announced. It has a 40,000-kw plant on this river just above its juncture with the Skagit and now would like to build a similar plant 7 miles farther up the Baker. Storage at the upper dam would add to power production at the lower plant. Cost of the new project is estimated unofficially at $12 million.

San Diego G&E Workers Get 25% Discount on Bills

San Diego Gas & Electric Co has put into effect a 25% discount system on electric and gas bills of its employees.

The plan became effective on December billings as a result of approval by the California Public Utilities Commission of a request submitted by San Diego G&E.

The company request was based on a number of suggestions for adoption of such a plan made in the employee opinion survey conducted for San Diego G&E by California Institute of Technology (EW, Oct. 26).

Nome, Alaska, Residents Vote $225,000 Bond Issue

Residents of Nome, Alaska, have voted a $225,000 bond issue to purchase the Northern Light & Power Co, which has been providing power to 600 customers, and for a street lighting system with a 655-kw diesel generating plant. The company is owned by O. S. Weaver of Santa Barbara, Calif.

The Seattle engineering firm of Metcalf & Harstad appraised the plant to be worth more than $225,000 and predicted few capital replacements would be necessary in years to come. The system is interconnected with a mining company whose power plant generates 5,000-kw.

The city has signed a financing arrangement with Grande & Co of Seattle. Revenue bonds will bear 5% interest.

A STANDARDIZED UNIFORM PRODUCT

The "Three E" Form A-1 line of INDOOR BUS SUPPORTS are designed to meet the operating conditions encountered in medium* size power plants, substations, customers vaults, etc.

They are available in voltage ratings of 5000, 7500, 15000 and 23000. Clamps can be had for flat bar (vertical or horizontal) tubing, rod, cable or other styles of conductors. Mounting bases are adaptable to pipe or flat surface mounting. The insulator unit is of high grade wet process porcelain, brown glazed.

This style of bus support has been in active production for almost thirty years. Thousands of them are in service.

Our ample stocks enable us to make prompt shipments.

*A line of heavy duty bus supports are available for large power installations.

Ask for new bulletin 226. It describes this line completely.

ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK, ILLINOIS

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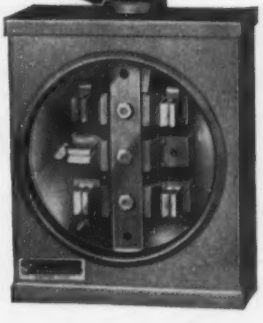

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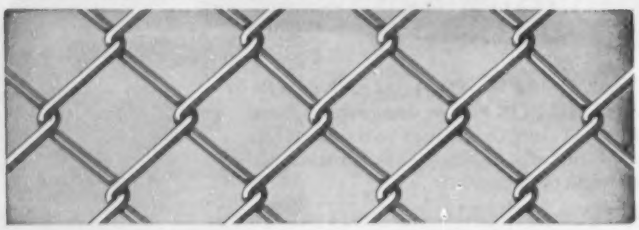

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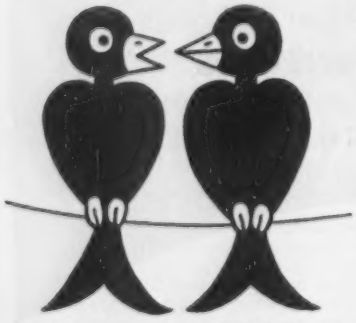

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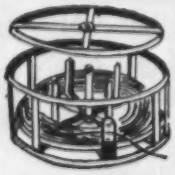

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● **PROTECTIVE ARRESTERS:** Introduction of a new order of equipment insulation protection is made with the Thorex Multi-Purpose lightning arrester. Complete listing of ratings and dimensions, with construction and performance features is included in publication 1292-H available from Ohio Brass Co, Mansfield, Ohio.

● **ACSR CONNECTORS AND TOOLS:** A publication especially developed to meet the needs of transmission and distribution engineers using ACSR conductors has been announced. A full line of fittings, portable hydraulic installing tools which are furnished in two packs so that a 2-man crew can set up for ground or overhead, and operation and maintenance instructions for the tools are covered. Ask for "T&B Method Transmission Line Connectors, Tools, and Accessories" from Thomas & Betts Co, Elizabeth 1, N. J.

● **LAB GLASSWARE WASHER:** A fully automatic glassware washer adapted especially for beakers, funnels, cylinders, graduates, flasks to 3 L, and many others has been announced. Appearance is similar to the Westinghouse dishwasher with front opening and top loading. For description and availability write to Westinghouse Electric Corp, Box 2278, Pittsburgh 30, Pa.

● **NEW BULLETINS BY GE:** The following have been announced by General Electric:

- GEA-5857 How to Select Meter Sockets for watthour meters.
- GEC-956 Indoor Current Transformers, Dry Type JKR-O, 600 v, 25/60, 200-800 amp.
- GEA-5469B Buyers Guide for Testing Instruments.
- GEA-6020 Hand Pyrometer, 0 to 1500 F, for surface, liquid, gas, molten metal.
- GEC-535C Automatic Time Switch, Type T-27.
- GEA-3541B Oil-Immersed Starters for Low-voltage Motors.
- GEA-6025 New All-angle Utility Motors, ¼ to 1 HP, for shop, farm & home.
- GEC-657E Electrode-selector Chart for GE Welding Electrodes.

For single copies of any or all of the above bulletins, write to General Electric Company, Schenectady 5, N. Y.

● **FUEL PULVERIZERS, SYSTEMS AND BURNERS:** A new 28-page catalog covering equipment for pulverizing and burning such fuels as lignite, petroleum coke, bituminous coal, anthracite, and coke breeze has been announced. All equipment is described and major recent installations are illustrated. Write to Foster Wheeler Corp, 165 Broadway, New York 6, N. Y. and ask for Bulletin BP-53-3.

● **AUTOMATIC OSCILLOGRAPH:** Full description and applications of an automatic oscillograph for recording photographically, the magnitudes, wave shapes, and phase relations of currents and voltages in power transmission circuits during unanticipated disturbances is given in bulletin GEC-396A. Seven elements can be traced simultaneously. Write to General Electric Co, Schenectady 5, N. Y.

● **DC CRANE MOTORS AND CONTROLS:** A new 12-page bulletin on d-c crane drive equipment covers crane motors, hoist controls, bridge and trolley controls, magnetic brakes, and switch and panel accessories. Ask for GEA-5408A from General Electric Co, Schenectady 5, N. Y.

● **MICROWAVE RADIO EQUIPMENT:** Application of the new 2000-Mc microwave radio equipment to electric utilities is described in a new booklet available from Westinghouse. Frequency division multiplexing, crystal frequency control, standby equipment, maintenance features, and the Type FR Microwave Radio and Type FJ Multiplexing equipment are covered. Write for booklet B-5850 to Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

● **METALLIC CONDUIT:** Protection of electric conductors in every type of construction is provided by Nikoh cold-rolled steel tubing. Available in ½ to 2 in. sizes and in 10 ft lengths, the lightweight tubing can be fabricated on the job with manual bending tools and compression couplings. Color coded tubing is also available. Ask for bulletins 5342 and 5334B from Nikoh Tube Co, 5000 S. Whipple St, Chicago 32, Ill.

● **PURIFIED ASBESTOS INSULATIONS:** A new 32-page publication under the title "Quintera—Quinorgo" covers electrical insulations made of purified asbestos. Advantages of design and production for use in core tubes, layer insulation, wire wrapping, interlaminate insulation, end washers and final wrapper insulation are covered, together with physical and electrical properties of the several available types of materials. Write to Johns-Manville, 22 East 40th St, New York 16, N. Y.

● **MOTOR STARTERS UP TO 3000 HP:** A new 12-page bulletin on Allis-Chalmers Type H starters for squirrel-cage, synchronous, wound rotor and multi-speed motors in ratings from 2200 to 5000 volts has been announced. Air or oil contactors are available. Short circuit, overload, time relay undervoltage, and pullout protection features are described. Write to Allis-Chalmers Manufacturing Co, 932 S. 70th St, Milwaukee, Wisconsin and ask for bulletin 14B6410B.

● **ELECTRIC WATER STERILIZER:** Up to 7000 gpm of water can be handled by a 95 lb, 110 v, 60 cycle ac sterilizer announced by Aquafine Company. Westinghouse Sterilamps emit powerful germ-killing ultraviolet rays which are passed through the water in a special helical contactor. For descriptive bulletin, write Aquafine Company, 1005 South Santa Fe Ave, Los Angeles 21, Calif.

● **OXYGEN ANALYZER AND RECORDER:** The paramagnetic susceptibility of oxygen is employed in a new magnetic oxygen analyzer covered by folder ND46-91, 8-pages. The application of this principle coupled with a recorder and sampling unit is fully described. Write to Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa.

● **ADJUSTABLE AC PRINTING PRESS DRIVES:** Bulletin GEA-5568A has been announced on ac adjustable speed drives for commercial printing equipment. Speed ranges of 3-1, 6-1, and 20-1 in ac motors of 3 to 50 hp are achieved without the use of regulating resistors. Advantages in space, production, maintenance and smooth running performance are covered in the bulletin. Ask for GEA-5568-A from General Electric Co, Schenectady 5, N. Y.

● **CONTACT POINT DRESSERS:** Now available to the electrical industry are Flex-Stone abrasive strips for contact point cleaning and dressing. A fast cutting hard abrasive is securely imbedded in a flexible synthetic strip material which is claimed to provide the most flexible and fastest cutting contact point dresser presently available. Write to Rinck-McIlwaine Inc, 16 Hudson St, New York 13, N. Y. Ask for Catalog P-1 and sample A.

● **INDUSTRIAL PRODUCTS:** A catalog on insulations, refractory products, packing, and gaskets is available from Johns-Manville, 22 E. 40 St, New York, N. Y.

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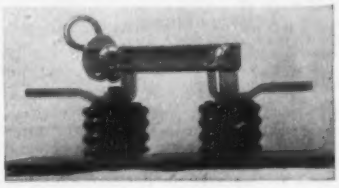

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TECHNICAL LITERATURE

Insulated Cable Up To 35,000 v—A 127-page publication under the title "Rubber Insulated High Voltage Power Cable Up To 35,000 volts" has been announced by The Okonite Company. Announcement coincides with the 75th anniversary of Okonite. The volume, OK-1075, is devoted to the complete explanation of why and how insulated cable can serve utilities and industrial plants requiring cables that will reliably transmit electric power at potentials up to 35,000 volts. The years of experience and research have resulted in cable to which eight distinct coverings are applied, namely, a conductor coating on the metal, semi-conducting tape over the conductor, the primary insulation, a rubber filled cable tape, creped paper tape, tinned copper shielding tape, Okoprene filled cable tape, and finally the Okoprene sheath of compounded neoprene. Also covered are special cable constructions, dimensional, engineering, splicing, terminating and splicing materials. Current carrying capacity table are in easy-to-read large type. Write to The Okonite Company, Passaic, N. J.

Directory of Safety Films—The National Safety Council has announced the 1953-54 edition of the National Directory of Safety Films. Over 900 motion pictures and slidefilms have been compiled by consulting all agencies known to the National Council. Subject matter includes occupational, home, traffic, first aid, fire prevention and civil defense, thereby providing training material for on and off-the-job. Copies at 75¢ each are available by writing National Safety Council, 425 N. Michigan Ave, Chicago 11, Ill.

Power Piping Ratings—The Pipe Fabrication Institute has just announced its new publication titled "Pressure-Temperature Ratings of Plain End Pipe Used In Power Plant Piping Systems". Over 5000 ratings were calculated by formula established in ASA and ASME codes in effect as of June 1, 1953. Although listed at $1.00, copies are available to readers of this column at no charge by writing The Pipe Fabrication Institute, 813 Clark Bldg, Pittsburgh 22, Pa.

Fuse Specs Up To 1000 volts—A 49-page specification for fuses by the International Electrotechnical Commission has been announced by the American Standards Assn. Fuses for ac and dc not exceeding 1000 volts are covered. Design, operation, breaking capacity, time-current zone, cut-off characteristics, temperature-rise, insulating characteristics, watts loss in fuse-links, contact protection with live parts, tests for compliance and methods of making tests are covered, together with markings on links, bases, and carriers. Available at $1.75 per copy from American Standards Association, 70 East 45th St, New York 17, N. Y.

Turbine Operating Outage 25-Year Report—A report by the Turbines and Condensers Subcommittee of the Prime Movers Committee of the Edison Electric Institute under the title "Turbine Operating and Outage Data for 1951" has been released. Outage data tables cover 311 turbines in operation up to 25 years. Ask for publication 53-10 from Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y. at the following prices. Members and their employees—40¢, Non-members in USA—$1.00, Foreign countries—$1.10.

New Applications of Silicon Carbide—A 52-page brochure on the currently effective uses of the generally known abrasive material, silicon carbide has been announced by The Carborundum Co, Niagara Falls, N. Y. The properties of silicon carbide as related to its use as a superrefractory, electric heating element to 1500 C, resistor, deoxidizer in metallurgy, catalyst carrier, and a porous media are covered. Address requests as above and ask for Facts About Silicon Carbide.

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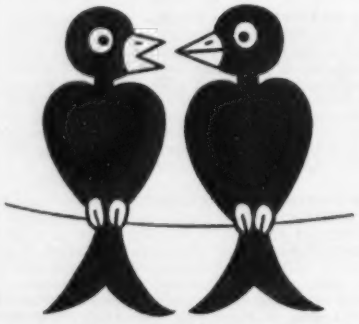

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Classified Advertising
EMPLOYMENT ... INESS
EQUIPMENT USED ... ESSES
OPPORTUNITIES

ELECTRICAL ENGINEERS

SENIORS—Experienced public utility electrical design, transmission and distribution engineers required by an established consulting organization for work on continued program of plant expansion, transmission and distribution planning and betterment work for public utility operating companies located in eleven Latin American countries. Headquarters New York; possibly some travel. Preferred age range 30-45. Attractive salaries. Excellent opportunities for qualified men. Reply stating age, education, experience and personal particulars.

P-1018E, Electrical World
330 W. 42 St. New York 36, N. Y.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

ELECTRICAL ENGINEER required for design of transmission and distribution lines for large public utility company located in Western Pennsylvania. Office and field work. Permanent employment with opportunity for advancement. Reply to P-1022, Electrical World.

WANTED: CHIEF Engineer for a medium sized growing eastern electric company to be in charge of transmission, distribution, construction, system planning. Must be technical graduate of proven executive ability. Age 40 to 48. Box P-1048, Electrical World.

POSITIONS WANTED

EXPERIENCED SWITCHBOARD Operator would like operating job in central or substation. PW-8267, Electrical World.

CENTRAL THERMAL Stations Constructor, electrical engineer, BSEE 1938, EE 1944, 37, single, registered, 15 years' experience particularly on large (200,000 KW-up) steam-electric central stations electrical construction supervision in U.S.A., except two years in Asia. Energetic coordinator—administrator. Some power utilities management, some practical civil at central stations. Wide civilian travel in North America, Europe, Asia; wide military travel in U.S.A. Available world wide. PW-1137, Electrical World.

METER ENGINEER with 16 years of experience in large utility companies is open for engagement. PW-1281, Electrical World.

SELLING OPPORTUNITY WANTED

SOUTHWEST SALES Engineer desires lines to Hardware, Electrical Industrial Wholesalers. SA-9218, Electrical World

WANTED

ANYTHING within reason that is wanted in the field served by Electrical World, can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

ADDITIONAL SEARCHLIGHT ADVERTISING
on Pages 166 and 167

If...

YOU CHANGE YOUR ADDRESS

Be sure to notify us at once, so future copies of ELECTRICAL WORLD will be delivered promptly.

Also make certain you have advised your local Post Master of your new address so other important mail doesn't go astray.

Both the Post Office and we will thank you for your thoughtfulness. Mail the information below to: Subscription Dept., ELECTRICAL WORLD, 330 W. 42nd St., New York 36, N. Y.

New

Name .....
Address .....
City ..... Zone.... State.....
Company ..... Title.....

Old

Name .....
Address .....
City ..... Zone.... State.....

ELECTRICAL WORLD
330 W. 42nd St.
New York 36, N. Y.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT: BUSINESS: **"OPPORTUNITIES"** EQUIPMENT USED OR RESALE

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Individual Spaces with border rules for prominent display of advertisements.

The advertising rate is $11.25 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on one column. 3 columns—30 inches—to a page.

PERSONNEL-INDUSTRIAL RELATIONS EMPLOYE TRAINING

Public utility companies located Latin America require men for positions of industrial relations engineers, and supervisors of employe training and personnel departments. Applicants should have at least 5 years experience in their particular specialty and general acquaintance with public utility operations. Knowledge of Spanish or Portugese desirable but not required initially. Positions offer promising fields for applicants with individual initiative, having good background of practical experience in their particular field. Salary commensurate with position, experience and living costs. Reply stating age, education, experience and personal particulars.

P-1020, Electrical World
330 W. 42 St. New York 36, N. Y.

DIESEL POWER PLANT

1—GM 12-567	720 K.W.
1—GM 12-567	600 K.W.
1—GM 8-268	300 K.W.

COMPLETE SWITCH GEAR 2300 V.

This plant now operating at Ft. Randall Dam, Pickstown, South Dakota. Complete with day tanks, fuel meters, etc. Logs for 4½ years operation available for inspection.

WILL SELL UNITS INDIVIDUALLY OR AS A COMPLETE PLANT.

JOHNSON-WINSTON

608 FOSHAY TOWER MINNEAPOLIS, MINNESOTA

ELECTRICAL ENGINEER ESTIMATOR

Public utility substations, transmission, distribution systems and electric installations in generating stations.

Experienced Estimator required with at least ten years experience in design, construction and cost estimates of public utility generating stations, substations, transmission and distribution systems, by organization servicing public utilities in eleven Latin American countries. State age, education, experience, personal particulars, and salary desired. Location New York—some travel; Spanish or Portuguese desirable but not necessary.

P-1283, Electrical World
330 W. 42 St., New York 36, N. Y.

ELECTRICAL ENGINEERS

JUNIORS—Graduate electrical engineers for station design, transmission and distribution work required by an established consulting organization for work on continued program of plant expansion, transmission and distribution planning and betterment work for public utility operating companies located in eleven Latin American countries. Headquarters New York—possibly some travel. Preferred age under 30. Experience 0-5 years. Salary commensurate with qualifications. Splendid opportunities for right men. Reply stating age, education, experience and personal particulars.

P-1019, Electrical World
330 W. 42 St. New York 36, N. Y.

J. L. HEMPHILL & CO.

ELECTRICAL ENGINEERS & EQUIPMENT

1606 53rd St. North Bergen, N. J. N.Y.C. Tel. LOngacre 5-3227 N. J. Tel. UNion 3-7600

TRANSFORMERS

1—1500 KVA G.E., 3 Ph., 4150V. 2300V. Pyranol
2—750 KVA G.E., 3 Ph., 4150V. 120/240V. sec.
2—750 KVA G.E., 1 Ph., 4600V. 115/230
2—400 KVA Pitts., 1 Ph., 2400/4800V. 240/48V.
3—333 KVA Whse., 1 Ph., 2400V. 600 V. sec.
2—300 KVA G.E., 1 Ph., 13200V. 220/440V.
1—200 KVA G.E., 3 Ph., 2400-220 sec.
3—200 KVA G.E., 1 Ph., 13200V. 440V.

SYNCHRONOUS MOTORS

1—300 H.P., Elec. Mach., 720 RPM. 3 Phase 60 cyc., 2200V T E F Cooled Outdoor service.
1—150 H.P., G.E., 1800 RPM. 220V. 3/60.
2—150 H.P., Al. Chal. 360 RPM. 440V. 3/60.

MOTOR GENERATOR SETS

1—1000 KW Whse., 600 V. 720 RPM. 4000 Syn.
1—1000 KW G.E., 600 V. 514 RPM. 4000 Syn.
1—1000 KW Whse., 275 V. 720 RPM. 4000 Syn.
1—200 KW Whse., 250V., 900 RPM. 4000V. Syn.
1—150 KW G.E., 126/250V. 1200 RPM. 2300 Syn.
1—100 KW G.E., 250V. 900 RPM. 2300V. Syn.

SLIP RING MOTORS

2—500 H.P., G.E., M 1200 RPM 2400 V.
1—400 H.P., West., CW. 450 RPM. 550V.
1—250 H.P., West., CW. 600 RPM. 440V.
1—200 H.P., West., CW. 600 RPM. 440V.
1—150 H.P., Al. Ch. 1800 RPM. 2300V., 3PH. 60 Cy.

Large Stock of A.C. and D.C. Equipment

FOR SALE

BRAND NEW *Meters*

In original cartons
1500 pieces

WEST. TYPE CA — 15 amp. 120v. 2-wire 60 cycle
G. E. TYPE I-30A — 15 amp. 120v. 2-wire 60 cycle

Offered subject prior sale at a Substantial Savings

ATLANTIC ELECTRIC METER CORP.
214 E. 41 St. New York 17, N. Y. Vanderbilt 6-1955
LARGE BUYERS OF METERS

2 TELEPHONES $25.95

Inter-communication handsets, two wire system. Included Two 3 volt batteries, 50 ft. of wire and simple wiring instructions. Additional wire 1 cent per ft. or $25.00 per mile. Complete list of telephone parts, handsets, magneto—common battery — and dial telephones, switchboards, etc. Write:

Telephone Engineering Co., Dept. F-2, Simpson, Pa.

WANTED

We are interested in the purchase of a ROOVERS TYPE EMBOSSING PRESS which will press pole tags from zinc tape. We will consider any reasonable offer for such machine if in fair working condition.

WATER & LIGHT DEPARTMENT
Wellsville, N. Y.

What is YOUR Problem?

Competent men for your staff? Employment?

Or, are you looking for — or offering — a business opportunity of special interest to men in the industry served by this publication?

The solution of any of these problems can logically be found *first* among *other* readers of Electrical World. You can get their attention—at small cost—through an advertisement in the Searchlight Section of

ELECTRICAL WORLD

SUBSTATION EQUIPMENT

TRANSFORMERS

QU.	KVA	MFR.	VOLTAGE
4	2500	Mol.	69000—13800
4	500	West.	69000—6900
3	400	G. E.	66000/33000—2300/4160
3	200	Pitts.	66000—2300
3	1250	A. C.	44000/11500—460
4	150	West.	44000/33000—2300/6600
3	75	West.	44000—7200/12470 Y
3	5000	G. E.	38100/66000—6600
4	4500	G. E.	3600—13300—2400
3	3333	G. E.	33000/11000—2400/7200
3	333	G. E.	33000—7200/12470 Y
3	250	Mol.	33000—13800/23900 Y
3	200	A. C.	34500—2400/7200/12470 Y
3	75	Wag.	33000—7200/12470 Y
3	1250	G. E.	26400/13200—2400
4	1500	A. C.	25400/44000 Y—6900/13800
4	450	A. C.	25410/44000 Y—13280/23000
3	1000	Mol.	22000—2300
1	1000	A. C.	22000—2200, 3 ph.
3	100	G. E.	22000—7200/12470 Y
3	50	G. E.	22000—2300
1	600	Stand.	13200—2300, 3 ph.
1	450	Penna.	13200—2400, 3 ph. ASKAREL
3	250	Pitts.	7200—220/440
3	150	Wag.	6900—2300
3	37½	G. E.	6900—230/460
41	150	G. E.	4800/2400—240/120
2	100	G. E.	4800/2400—480/240
3	333	G. E.	2400/4160 Y—240/480
3	250	G. E.	2300/4000 Y—115/230
3	200	West.	2400—240/480
3	150	West.	2400—230/115
1	100	G. E.	2300—575, 3 ph.
6	50	West.	2400—114/228 DRY TYPE

INDUCT. REGULATORS—Outdoor

1—1510 KVA West. 660 Amp. 13200 V. 3 ph.
1— 390 KVA G. E.-Step, 541 Amp. 4160 V. 3 ph.
1— 140 KVA G. E. 200 A. 4000 V. 3 ph.
3— 96 KVA G. E. 200/400 A. 2400 V. 1 ph.
3— 48 KVA West. 200 A. 2400 V. 1 ph.
8— 36 KVA West. 150/300 A. 2400 V. 1 ph.
2— 36 KVA G. E. 75/150 A. 4800 V. 1 ph.

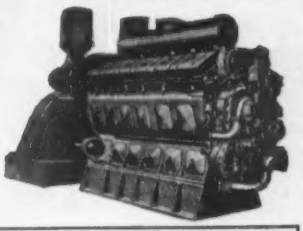
CIRCUIT BREAKERS

4— 800 A. 132 KV West. G-222A-2500 MVA
2— 400 A. 37 KV G. E. FHKO-136-350 MVA
1—1200 A. 15 KV G. E. FKO-139-350 MVA
4— 600 A. 15 KV G. E. FHKO-139-750 MVA

BREW, WOLTMAN & Co., Inc.
52 Church Street New York 7, N. Y.

DIESEL POWER

IMMEDIATE SHIPMENT
• PURCHASE OR RENTAL
UNIT CAPACITIES—10 TO 2475 KVA
A.C.—50 AND 60 CYCLES
• ALSO D.C. UNITS



A PARTIAL LISTING OF OUR INVENTORY

KW	Make	Model	HP	RPM	KW	Make	Model	HP	RPM
1980	Nordberg	TS-217	2800	225	320	Enterprise	DSG-6	560	450
1136	Fairbanks Morse	38D	1600	720	300	General Motors	8-268A	450	1200
1100	General Motors	16-278A	1600	720	200	General Motors	8-268A	350	900
750	General Motors	12-567	1080	720	150	Worthington	CC-4	225	450
500	Baldwin	VO-8	750	514	150	Ingersoll-Rand	S-4	225	600
500	General Motors	8-278A	750	720	150	Buckeye	80	240	600
500	General Motors	8-567	720	720	100	Worthington	BB-5	150	600
480	Worthington	DD-8	700	360	100	General Motors	3-268A	150	1200
400	Ingersoll-Rand	S-8	600	720	80	General Motors	6-71	90	1200
350	Baldwin	VO-6	510	450	30	Internat'l Harvester	UD-14	45	1200

A. G. SCHOONMAKER COMPANY, INC.
DIESEL DIVISION, 50 CHURCH ST., NEW YORK 7, N. Y.

FROM AVAILABLE STOCK

TURBO GENERATORS IN STOCK

Qu.	KW	Make	Desc.
1	1000	G.E.	Non-Cond—190 lbs-2400-3-60
1	1000	Moore	Condensing—Extraction—190 lbs., 2400-3-60—Surface Cond.
1	750	G.E.	Condensing—265 lbs., 440-3-60 Built 1944
1	500	Moore	Non-Cond—150/200 lbs., 5/35 lbs. B.P., 480-3-60 Dir. Conn. Exciter.
1	300	G.E.	Non-Cond—150/175 lbs., 5/10 lbs. B. P., 480-3-60
1	200	Whse.	Non-Cond. 125/150# 18P 5/10# B.P., 240/480 v-3-60

FERQUENCY CHANGERS

Qu.	Kva	Make	Cycles	Voltages
1	12500	Whse.	25/60	13200 x 13200
1	3750	G.E.	25/60	4150/2400 x 2400/4150
1	3125	G.E.	25/60	4150/2400 x 2400/4150
2	2500	G.E.	25/62½	2300 x 4160
1	1250	G.E.	25/58.3	4400 x 2300
1	625	A.C.	25/60	11000 x 2300

MOTOR GENERATOR SETS
3 ph, 60 cy.

Qu.	KW	Make	Speed	DC Volts	AC Volts
1	3000 3U	G.E.	514	600	4000/13200
2	2000	G.E.	450	250	2400
2	2000	G.E.	514	600	6600/13200
1	2000	G.E.	500	666 25 cy.	11000
2	1750	G.E.	514	250	2400
1	1500	C.W.	514	115	4000/13800
1	1500	G.E.	720	600	13200
1	1000	G.E.	900	260	4100/6900
2	1000	Whse.	900	600	2300/4150
1	750	Whse.	900	275	2300/4150
1	500	Whse.	1200	125/250	2300
1	500	Whse.	900	250	440
1	500	G.E.	720	125	2300

TRANSFORMERS—60 Cycle

KVA	Make	Type	Ph	Voltages
1—5000	Whse.	OISC	3	33000x26400/13200
1—3500	G.E.	WCT	3	13800 x 2300/440
1—2500	Whse.	OISC	3	26400/13200 x 480
3—2000	G.E.	HVDDJ	1	66000 x 13800
3—1250	G.E.	HVDDJ		6600/550
3—1000	G.E.	HVDDJ	1	2200/480

BELYEA COMPANY, INC.
OFFICE & SHOP
51 Howell St. Jersey City 6, N. J.

WORLD'S LARGEST INVENTORY

FREE CATALOG

MOTORS—GENERATORS—TRANSFORMERS
New and Guaranteed Rebuilt
1 H.P. to 2500 H.P.

ELECTRIC EQUIPMENT CO.
P. O. BOX 51, ROCHESTER 1, N.Y.

FOR SALE

3 G. E. Transformers, 200 KVA, Type H, Single Phase, Cy. 60 13200—2400/4160Y Voltage Rating

1 G. E. Oil Circuit Breaker, Volts 7500, Amp. 400, Cy. 60, Type FK-142

3 G. E. Instrument Current Transformers Model 9 JKFS8, Impulse Level 95KV Amps. 75, Cy. 25-125

In excellent condition, new in 1943. If interested please contact

CHARLES T. BRANDT, INC.
1700 Ridgely Street
Baltimore 30, Md.

ELECTRICAL WIRE AND CABLE

—YOUR BEST SOURCE—
- for every industrial and power application
- odd lengths—long and short —reasonably priced
- largest stock in Midwest
- varnished cambric — leaded — neoprene

Let us quote on requirements—send your inquiries

DELIVERY
QUICK . . . from stock
We'll also buy your Surplus

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UNIVERSAL Wire and Cable Co.
2660 N Clybourn Ave., Chicago 14, Ill.
EAstgate 7-4777 Code: UNIWIRE

TRANSFORMERS FOR SALE

6—1000KVA Mol 11500-2400/4160Y
6—833 KVA G-E 35000-480
3—667 KVA W-H 35000-480
3—333KVA G-E 33000-2300/6900
3—333KVA G-E 33000-2300/4000Y
3—333KVA Mol 7200/12470Y-2400/4160Y
3—333KVA W-H 6600/2300
3—200KVA G-E 2400/4160Y-120/240
3—150KVA G-E 44000-600/2400
3—150KVA G-E 19050/33000Y-2540/4400Y
3—100KVA G-E 33000-6900/11950Y
3—50KVA A-Ch 33000-2300/4160Y
1—500KVA W-H 27600-444/131 3-ph.
1—150KVA G-E 7620/13200Y-120/208Y 3-ph.

Many other items in stock

TRANFORMERS WANTED

Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.
Cincinnati 27, Ohio
40 Years' Dependable Service

REBUILT AND NEW

GUARANTEED MOTORS
M.G. SETS • GENERATORS
Hoists • Compressors • Transformers
Units of Every Size and Description
WE'LL SELL, BUY OR TRADE
Phone CANAL 6-2900

CHICAGO *Electric Co.*
1324 W. CERMAK ROAD
CHICAGO 8, ILL.

TURBO GENERATOR
Available Immediately
7500 KW G.E. Co.
180 P.S.I.—525°F Total Temp.
3 phase 60 cycle 2300 volt
With Surface Condenser
GOOD CONDITION

Union Electric Co. of Missouri
315 N. 12th Blvd. St. Louis 1, Mo.

Planning A Fly Ash Recovery Installation?

Consider these important advantages of a WESTERN PRECIPITATION CMP UNIT!

IF YOU are planning the installation of any type of fly ash recovery equipment—mechanical or electrical—it will pay you to investigate the extra advantages to be gained by installing a CMP Unit designed, engineered and constructed under *one* responsibility by Western Precipitation Corporation—*leaders in both electrical and mechanical recovery fields!*

(Top) View of CMP unit on Utah Power & Light installation. Note compactness of unit. (Above) Close-up of same installation.

Combines Mechanical and Electrical Advantages:

A CMP (Combination Multiclone-Cottrell Precipitator) Unit combines—in one compact installation—both mechanical and electrical recovery principles, so that maximum benefit is obtained from the advantages inherent in each method. The MULTICLONE section centrifugally cleans the gases of the larger and heavier fly ash particles (down to a few microns in diameter) . . . and the COTTRELL Precipitator then electrically removes the very small particles remaining in the gases. This combination arrangement has important advantages:

1. Using the MULTICLONE for cleaning out the heavier particles permits the bulk of the recovery operation to be performed with relatively low-cost equipment.

2. Using the COTTRELL for final clean-up insures unusually high recovery efficiency—approaching theoretically perfect, if desired—with a high efficiency, compact Precipitator unit.

3. Each type of unit—MULTICLONE and COTTRELL—can be arranged for its most efficient application. MULTICLONES may be connected to each separate boiler, if desired, and their draft requirement cut out when the boiler is down . . . while a central COTTRELL handles all gases and operates at higher efficiencies, with continued low power cost, when one or more boilers are down.

4. During soot-blowing periods, or while warming up cold boilers, the MULTICLONE efficiency usually increases, preventing overloads of detrimental carbon from reaching the COTTRELL.

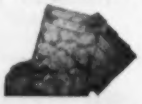
Only Western Precipitation Combines Multiclone and Cottrell "Know-How"—In ONE Organization!

in that it not only pioneered the commercial application of COTTRELL Electrical Precipitators over 43 years ago, but also has been a leader for many years in the *mechanical* recovery field with its widely-recognized MULTICLONE Collectors.

Result—Western Precipitation has the all-important "know-how" and experience in BOTH fields . . . knows from first-hand experience how to fit the *right* equipment in the *right* place, to do *your particular* job . . . and can provide the complete installation under ONE responsibility and ONE overall guarantee!

Let Our Experienced Engineers study your recovery requirements and make recommendations on the equipment best suited to your operations. A wire, phone call or letter to our nearest office places this unique "Know-How" at your service, without obligation!

Send for descriptive literature!



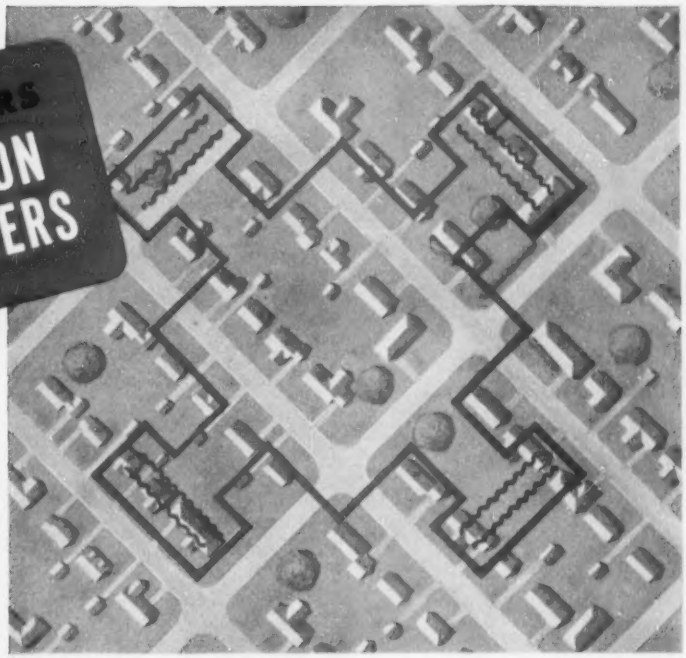
WESTERN Precipitation CORPORATION

DESIGNERS AND MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

Main Offices: 1004 WEST NINTH STREET, LOS ANGELES 15, CALIFORNIA
CHRYSLER BLDG., NEW YORK 17 • 1 N. La SALLE ST. BLDG., CHICAGO 2
1429 PEACHTREE ST. N.E., ATLANTA 5 • HOBART BLDG., SAN FRANCISCO 4
PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

Get Network Advantages for Heavy Load Density Areas

ALLIS-CHALMERS
DISTRIBUTION TRANSFORMERS



ACPB TRANSFORMERS MAKE SECONDARY BANKING ECONOMICAL

You can distribute secondary loads and temporary overloads evenly and economically with Allis-Chalmers ACPB distribution transformers. They permit bringing network advantages — improved service continuity, better voltage regulation, and less flicker from 120-volt starting loads — to heavy load density sections of urban and suburban areas. ACPB transformers permit simplified paralleling of secondaries on systems fed by a common primary feeder.

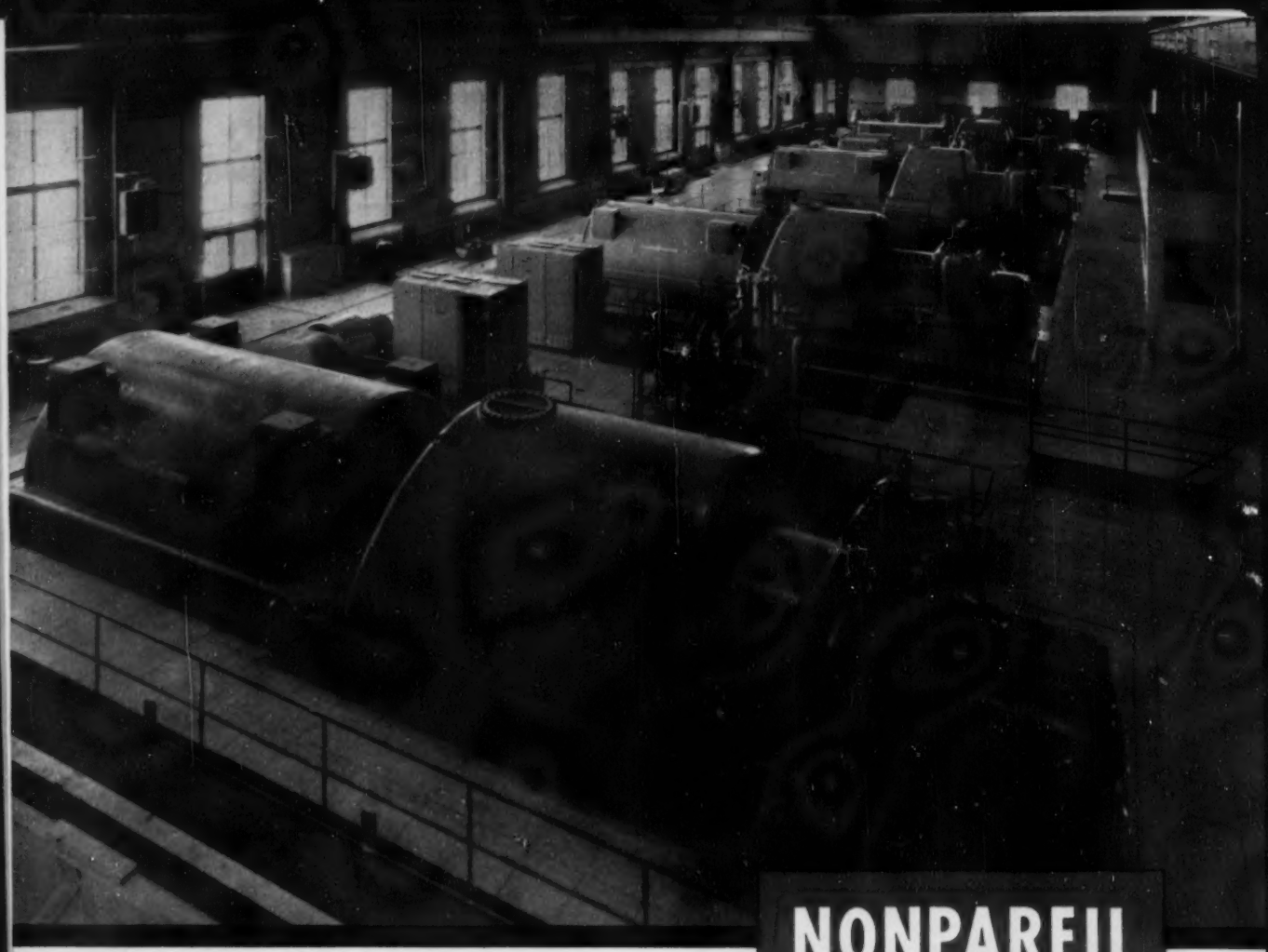
Reduce total transformer capacity requirements. When ACPB transformers are distributing diversified loads efficiently, you can add capacity without increasing copper size. All you do is replace a transformer with one of a larger rating or add in another transformer of the same size to the circuit. Secondary fuses are completely eliminated.

Allis-Chalmers ACPB transformers are supplied as a package that includes built-in lightning and system protection. To give short circuit and overload protection — plus a means of sectionalizing secondary faults — two internal low voltage breakers with separate external reset handles are provided. Two signal lights give visible warning of breaker operation.

Get the complete story on the advantage of Banked Secondary Systems from your nearby Allis-Chalmers District Office or write Allis-Chalmers, Milwaukee 1, Wisconsin for Bulletin 61B8054.

A-4218

ALLIS-CHALMERS



NONPAREIL
TRADE MARK
Turbine Oil

Here's powerful evidence of the benefits offered by . . .

■ Since 1940, the Indianapolis Power and Light Company has put NONPAREIL Turbine Oil into one new turbine after another. Today, this rapidly growing company has eight big turbines—with 363,000 KW capability—operating on this unique lubricant.

During the 13 years it has been in use, NONPAREIL has provided convincing evidence of its ability to eliminate oil replacements and oil-system cleaning. None of the original fills of NONPAREIL have needed to be replaced. Neutralization numbers have stayed below 0.07 mg. KOH/gm. Oil systems have remained entirely clear.

The lubricant and maintenance savings realized by this utility are just the beginning. Trouble-free lubrication and consequent savings are *assured for the life of the eight turbines* in normal operation. This is based on the written guarantee, given with each fill of NONPAREIL, that this outstanding lubricant will last as long as the turbine, and that its neutralization number will stay below 0.15 mg. KOH/gm.

The Standard Oil lubrication specialist serving your section of the Midwest will be glad to show you lubrication records of NONPAREIL in installations similar to your own. These records cover up to 25 years' continuous operation of individual units on original fills of oil. You can contact this specialist by phoning your local Standard Oil Company, 910 South Michigan Ave., Chicago 80, Illinois.

STANDARD OIL COMPANY

STANDARD *(Indiana)*